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IMPROVED WATER WHEEL.

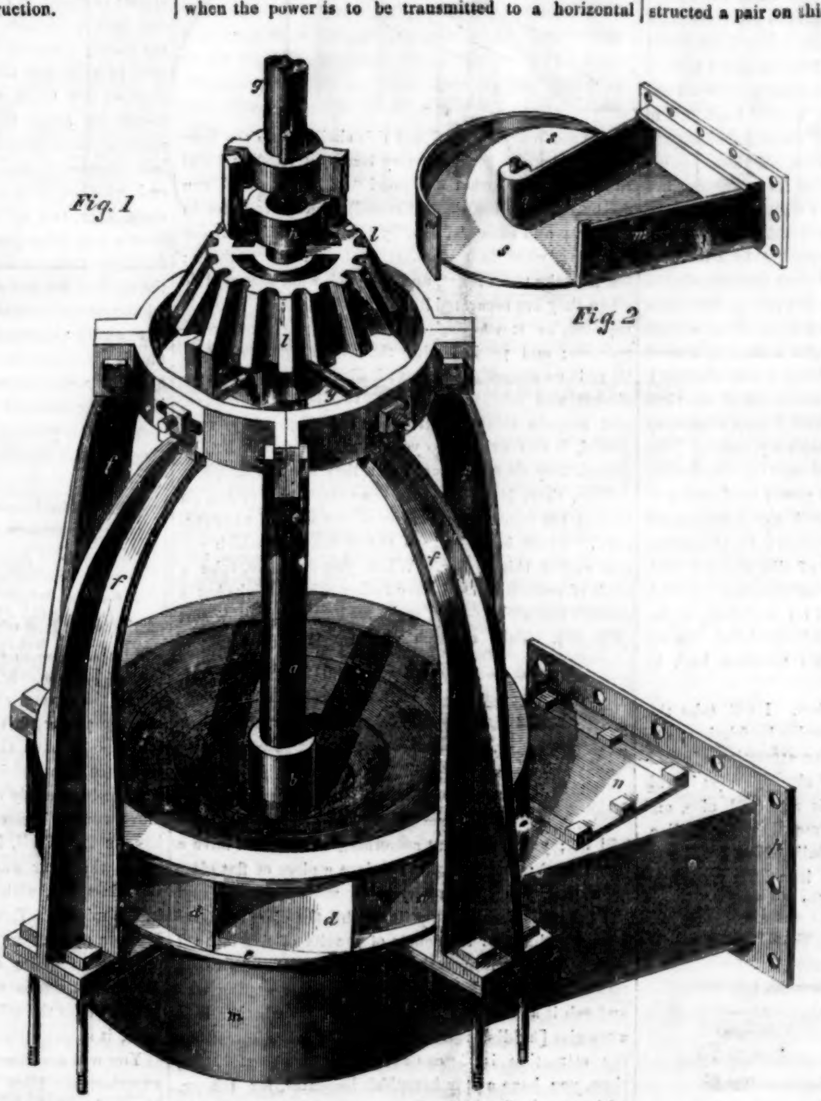
The invention here illustrated is a water wheel, constructed upon the simplest plan consistent with a high useful effect; it presents a remarkable combination of strength, compactness and durability.

Fig. 1 represents the wheel put together, ready to be attached to a forebay or penstock.

Fig. 2 represents the scroll or spiral water passage into the wheel, with part of the top and side removed, in order to show its internal construction.

The wheel, when not running, rests upon pivot, *r*, which, when the wheel is in motion, acts as a guide only to keep it in its proper place. This pivot, *r*, is made of cast steel, and screwed into the hollow cylindrical part, *q*. S is the bottom of the spiral water passage, which rises with such a grade, that a sufficient quantity of water is conveyed to each bucket continually. *m* is the outer rim of this spiral water passage, which is represented with part of it cut away, so as the better to show its inner construction. *p* is a flange surrounding the inlet or chute into said scroll or water passage; this flange, *p*, has holes drilled through it for the purpose of bolting it to the forebay. This stationary part of the wheel, Fig. 2, is cast in one piece and requires no core, except a small one for forming the hollow in central part, *q*. The upper edge of the outer rim, *m*, is turned true, in order to form a water-tight joint with a ring, *e*, Fig. 1, which forms the lower part of the wheel.

In Fig. 1, *a* is the shaft, *b* the hub of the disk, *c* of the wheel. To this disk, *c*, the buckets, *d*, are attached. The lower and outer parts of these buckets are firmly held in place by a flat ring, *e*, which extends from the outer edge of these buckets, inwards, to the inner edge of rim, *m*, of the spiral water passage, with which it forms a water-tight joint. This ring, *e*, also serves to reduce the upward pressure of the water against the disk, *c*. The buckets, *d*, extend from the lower end of hub, *b*, across the top of the spiral water passage to the outer edge of disk, *c*, and ring, *e*, as represented. These buckets have no twist, and are therefore easily shaped by hand or otherwise. When the wheel is properly loaded, the water leaves these buckets in a radial line; and when too lightly loaded, in a tangential line with the course of the water in the scroll; and if too heavily loaded, in a tangential direction contrary to the course of the water in the scroll. *n* is a man-hole through which chunks and other obstructions are removed from the inside of the wheel and scroll. The wheel should always be entirely immersed in the escape water. The lower shaft, *a*, is made short, so as to be free from vibration. It is held in place by the four standards, *f*, and is truly trained by the four training screws, *y*. The result is that the wheel revolves smoothly upon the scroll rim, *m*, without losing water through the joint where the two meet, and without unnecessary wear to this joint caused by vibrations. These standards, *f*, rest upon four flanges cast on to the scroll, which also serve for the purpose of attaching the scroll to timbers placed in the wheelpit for that purpose. *l* is a bevil wheel, used when the power is to be transmitted to a horizontal



LITTLEPAGE'S IMPROVED WATER WHEEL.

shaft. *g* is the shaft through which the power is transmitted to the work to be done; it is resting loosely upon the top of shaft, *a*, and is driven by clutches, *h* and *k*. By this arrangement, any irregularities in this upper shaft, *g*, and attachments, are not transmitted to the lower shaft and water-tight joint of the wheel. This wheel has but one water-tight joint, while almost every other wheel has two and more.

The upward pressure of the water against disk, *c*, is, in almost every case, greater than the weight of wheel, shaft, and all attachments. It is therefore necessary to provide a cavity in the top of shaft, *a* or *g*, for the purpose of holding oil and the blunt end of a regulating screw, with which the wheel is held down—just sufficient to prevent the loss of water at the revolving joint, and not so much as to cause friction in said joint. Therefore, all the wear and friction is at this screw—always in sight and adjustable.

When wheels upon a horizontal shaft are desired for driving sash or muley saws or pumps, two are made—a right and a left wheel, attached to the same shaft, with a double scroll between them. The inventor has constructed a pair on this plan, attached to a sash saw, and finds them to operate fully equal to his utmost expectations, although constructed of wood and iron and shaped in a country blacksmith shop. M. Casner, who also has one of these wheels upon a vertical shaft, can be addressed at Round Mountain Post-office, Texas. This wheel has given entire satisfaction in every instance. The inventor had expected to give some authentic proof of the capacities of his wheel before bringing the same before the public; and for that purpose he was a competitor at the recent trials of water wheels at Fairmount. After having there witnessed the test of the wheels on exhibition he writes that he believed that none could surpass his own in producing a high per centage of power, while none could approach it in simplicity and economy of construction and durability. The inventor claims that the question of championship among water wheels is yet to be decided, and desires that it may be done in such a manner that a difference of from 13 to 18 per cent in the results of tests with identical wheels unaccounted for may not again take place.

This wheel was patented, through the Scientific American Patent Agency, by Caleb V. Littlepage, on the 8th of February, 1859, whose address, for further information, is Austin City, Texas.

NEW CALIFORNIA STEAMER.—The Pacific Mail Steamship Company have lately contracted with Wm. H. Webb for a large steamer, destined for the San Francisco and Panama route. The following are to be her dimensions: Length of deck, 340 feet; breadth of beam, outside, 45 feet, 44 feet moulded; and depth of hold, 32 feet. She will be one thousand tons larger than the *John L. Stevens*. Her engine is to be of the single beam variety, with a cylinder of 9.5 inches in diameter and 12 feet stroke, and will have extra capacity of boilers. She is to be constructed of the very best materials, with diagonal iron straps—her construction to be under the superintendence of Captain Skiddy. She will have water-tight compartments; and special attention is to be paid to the ventilation of the passenger's department.

SCIENCE MADE POPULAR.

PROFESSOR FARADAY'S LECTURES ON THE PHYSICAL FORCES.

LECTURE V.—MAGNETISM—ELECTRICITY.

I wonder whether we shall be too deep to-day or not. Remember that we spoke of the attraction by gravitation of *all* bodies to all bodies by their simple approach. Remember that we spoke of the attraction of particles of the *same* kind to each other—that power which keeps them together in masses—iron attracted to iron, brass to brass, or water to water. Remember that we found, on looking into water, that there were particles of two *different* kinds attracted to each other; and this was a great step beyond the first simple attraction of gravitation, because here we deal with attraction between *different* kinds of matter. The hydrogen could attract the oxygen and reduce it to water, but it could not attract any of its own particles, so that there we obtained a first indication of the existence of *two* attractions.

To-day we come to a kind of attraction even more curious than the last, namely, the attraction which we find to be of a double nature—of a curious and dual nature. And I want, first of all, to make the nature of this doubleness clear to you. Bodies are sometimes endowed with a wonderful attraction, which is not found in them in their ordinary state. For instance: here is a piece of shellac, having the attraction of gravitation, having the attraction of cohesion, and, if I set fire to it, it would have the attraction of chemical affinity to the oxygen in the atmosphere. Now, all these powers we find in it as if they were parts of its substance; but there is another property which I will try and make evident by means of this ball, this bubble of air [a light india-rubber ball, inflated and suspended by a thread]. There is no attraction between this ball and this shellac at present; there may be a little wind in the room slightly moving the ball about, but there is no attraction. But if I rub the shellac with a piece of flannel [rubbing the shellac, and then holding it near the ball], look at the attraction which has arisen out of the shellac simply by this friction, and which I may take away as easily by drawing it gently through my hand. [The lecturer repeated the experiment of exciting the shellac, and then removing the attractive power by drawing it through his hand.] Again: you will see I can repeat this experiment with another substance; for if I take a glass rod and rub it with a piece of silk covered with what we call amalgam, look at the attraction which it has; how it draws the ball toward it; and then, as before, by quietly rubbing it through the hand, the attraction will be all removed again to come back by friction with this silk.

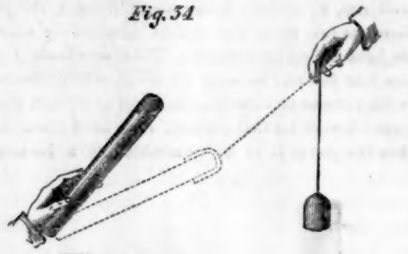
But now we come to another fact. I will take this piece of shellac and make it attractive by friction; and remember that, whenever we get an attraction of gravity, chemical affinity, adhesion or electricity (as in this case), the body which attracts is attracted also, and just as much as that ball was attracted by the shellac, the shellac was attracted by the ball. Now I will suspend this piece of excited shellac in a little paper stirrup in this way (Fig. 33), in order to make it move

Fig. 33

easily, and I will take another piece of shellac, and, after rubbing it with flannel, will bring them near together: you will think that they ought to attract each other; but now what happens? It does not attract—on the contrary, it very strongly repels; and I can thus drive it round to any extent. These, therefore, repel each other, although they are so strongly attractive—repel each other to the extent of driving this heavy piece of shellac round and round in this way. But if I excite this piece of shellac as before, and take this piece of glass and rub it with silk, and then bring them near, what think you will happen? [The lecturer held the excited glass near the excited shellac, when they attracted each other strongly.] You see, therefore, what a difference there is between these two attractions; they are actually two kinds of attraction concerned in this case, quite different to anything we have met with before, but the force is the same. We have here, then, a double attraction—a dual attraction or force—one attracting and the other repelling.

Again, to show you another experiment which will help to make this clear to you: suppose I set up this rough indicator again [the excited shellac suspended in the stirrup]; it is rough, but delicate enough for my purpose; and suppose I take this other piece of shellac and take away the power, which I can do by drawing it gently through the hand; and suppose I take a piece of flannel (Fig. 34), which I have shaped into a cap for

Fig. 34



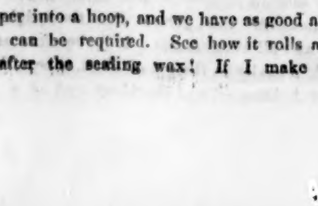
it and made dry. I will put this shellac into the flannel, and here comes out a very beautiful result. I will rub this shellac and the flannel together (which I can do by twisting the shellac round), and leave them in contact; and then if I ask, by bringing them near our indicator, what is the attractive force? it is nothing; but if I take them apart, and then ask what they will do when they are separated? why, the shellac, is strongly repelled, as it was before, but the cap is strongly attractive; and yet if I bring them both together again, there is no attraction—it has all disappeared [the experiment was repeated]. Those two bodies, therefore, still contain this attractive power; when they were parted, it was evident to your senses that they had it, though they do not attract when they are together.

This, then, is sufficient, in the outset, to give you an idea of the nature of the force which we call ELECTRICITY. There is no end to the things from which you can evolve this power. When you go home, take a stick of sealing wax—I have rather a large stick, but a smaller one will do—and make an indicator of this sort (Fig. 35). Take a watch glass (or your watch itself

Fig. 35

will do; you only want something which shall have a round face); and now, if you place a piece of flat glass upon that, you have a very easily moved center; and if I take this lath and put it on the flat glass (you see I am searching for the center of gravity of this lath; I want to balance it upon the watch glass), it is very easily moved round; and if I take this piece of sealing wax and rub it against my coat, and then try whether it is attractive [holding it near the lath], you see how strong the attraction is; I can even draw it about. Here, then, you have a very beautiful indicator, for I have, with a small piece of sealing wax and my coat, pulled round a plank of that kind; so you need be in no want of indicators to discover the presence of this attraction. There is scarcely a substance which we may not use. Here are some indicators (Fig. 36). I bend round a

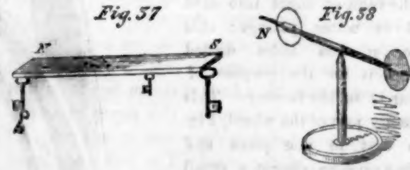
Fig. 36



strip of paper into a hoop, and we have as good an indicator as can be required. See how it rolls along, traveling after the sealing wax! If I make them smaller, of course we have them running faster, and sometimes they are actually attracted up into the air. Here, also, is a little collodion balloon. It is so electrical that it will scarcely leave my hand unless to go to the other. See how curiously electrical it is; it is hardly possible for me to touch it without making it electrical; and here is a piece which clings to anything it is brought near, and which it is not easy to lay down. And here is another substance, gutta-percha, in thin strips: it is astonishing how, by rubbing this in your hands, you make it electrical; but our time forbids us to go farther into this subject at present; you see clearly there are two kinds of electricities which may be obtained by rubbing shellac with flannel or glass with silk.

Now, there are some curious bodies in nature (of which I have two specimens on the table) which are called *magnets* or *loadstones*; ores of iron, of which there is a great deal sent from Sweden. They have the attraction of gravitation and attraction of cohesion and certain chemical attraction; but they also have a great attractive power, for this little key is held up by this stone. Now that is not chemical attraction; it is not the attraction of chemical affinity, or of aggregation of particles, or of cohesion, or of electricity (for it will not attract this ball if I bring it near it), but it is a separate and dual attraction, and, what is more, one which is not readily removed from the substance, for it has existed in it for ages and ages in the bowels of the earth. Now we can make artificial magnets (you will see me to-morrow make artificial magnets of extraordinary power). And let us take one of these artificial magnets and examine it, and see where the power is in the mass and whether it is a dual power. You see it attracts these keys, two or three in succession, and it will attract a very large piece of iron. That, then, is a very different thing indeed to what you saw in the case of the shellac, for *that* only attracted a light ball, but here I have several ounces of iron held up. And if we come to examine this attraction a little more closely, we shall find it presents some other remarkable differences; first of all, one end of the bar (Fig. 37) attracts the key, but the middle does not attract. It is not, then, the *whole*

Fig. 37 *Fig. 38*



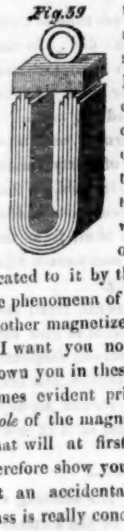
of the substance which attracts. If I place this little key in the middle, it does not adhere; but if I place it *there*, a little nearer the end, it does, though feebly. Is it not, then, very curious to find that there is an attractive power at the extremities which is not in the middle—to have thus in one bar two places in which this force of attraction resides? If I take this bar and balance it carefully on a point, so that it will be free to move round, I can try what action this piece of iron has on it. Well, it attracts one end, and it also attracts the other end, just as you saw the shellac and the glass did, with the exception of its not attracting in the middle. But if now, instead of a piece of iron, I take a magnet and examine it in a similar way, you see that one of its ends *repels* the suspended magnet; the force, then, is no longer attraction, but repulsion; but if I take the other end of the magnet and bring it near, it shows attraction again.

You will see this better perhaps by another kind of experiment. Here (Fig. 38) is a little magnet, and I have colored the ends differently so that you may distinguish one from the other. Now this end, S, of the magnet (Fig. 37) attracts the *uncolored* end of the little magnet. You see it pulls toward it with great power; and, as I carry it round, the uncolored end still follows. But now, if I gradually bring the middle of the bar magnet opposite the uncolored end of the needle, it has no effect upon it, either of attraction or repulsion, until, as I come to the opposite extremity, N, you see that it is the *colored* end of the needle which is pulled toward it. We are now, therefore, dealing with two kinds of power, attracting different ends of the magnet—a double power already existing in these bodies, which takes up the form of attraction and repulsion. And now, when I put up this label with the word MAG-

NETISM, you will understand that it is to express this double power.

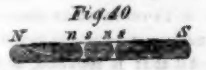
Now with this loadstone you may make magnets artificially. Here is an artificial magnet (Fig. 39) in which both ends have been brought together in order to increase the attraction. This mass will lift that lump of iron, and, what is more, by placing this *keeper*, as it is called, on the top of the magnet, and taking hold of the handle, it will adhere sufficiently strongly to allow itself to be lifted up, so wonderful is its power of attraction. If you take a needle and just draw one of its ends along one extremity of the magnet, and then draw the other end along the other extremity, and then gently place it on the surface of some water (the needle will generally float on the surface, owing to the slight greasiness communicated to it by the fingers), you will be able to get all the phenomena of attraction and repulsion by bringing another magnetized needle near to it.

Fig.39



I want you now to observe that, although I have shown you in these magnets that this double power becomes evident principally at the extremities, yet the *whole* of the magnet is concerned in giving the power. That will at first seem rather strange; and I must therefore show you an experiment to prove that this is not an accidental matter, but that the whole of the mass is really concerned in this force, just as in falling the whole of the mass is acted upon by the force of gravitation. I have here (Fig. 40) a steel bar, and I

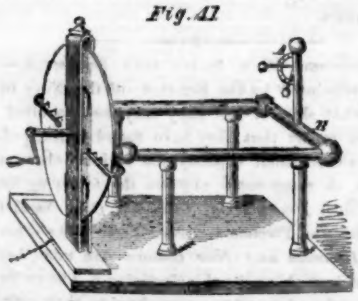
Fig.40



am going to make it a magnet by rubbing it on the large magnet (Fig. 39). I have now made the two ends magnetic in opposite ways. I do not at present know one from the other, but we can soon find out. You see, when I bring it near our magnetic needle (Fig. 38), one end repels and the other attracts; and the middle will neither attract nor repel—it *cannot*, because it is half way between the two ends. But now if I break out that piece, *n s*, and then examine it, see how strongly one end, *n*, pulls at this end, S (Fig. 38), and how it repels the other end, N. And so it can be shown that every part of the magnet contains this power of attraction and repulsion, but that the power is only rendered evident at the end of the mass. You will understand all this in a little while; but what you have now to consider is that every part of this steel is in itself a magnet. Here is a little fragment which I have broken out of the very center of the bar, and you will still see that one end is attractive and the other is repulsive. Now, is not this power a most wonderful thing? And very strange, the means of taking it from one substance and bringing it to other matters. I cannot make a piece of iron or anything else heavier or lighter than it is; its cohesive power it must and does have; but, as you have seen by these experiments, we can add or subtract this power of magnetism, and almost do as we like with it.

And now we will return for a short time to the subject treated of at the commencement of this lecture. You see here (Fig. 41) a large machine arranged for

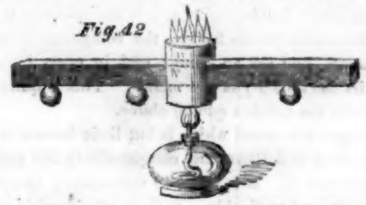
Fig.41



the purpose of rubbing glass with silk, and for obtaining the power called *electricity;* and the moment the handle of the machine is turned a certain amount of electricity is evolved, as you will see by the rise of the little straw indicator at A. Now I know, from the appearance of repulsion of the pith ball at the end of the straw, that electricity is present in those brass conductors, B B, and I want you to see the manner in which that electricity can pass away [touching the conductor, B, with his finger, the lecturer drew a spark from it, and the straw electrometer immediately fell]. There, it has all gone; and that I have really taken it away, you shall see by an experiment of this sort. If I hold this cylinder of brass by the glass handle, and touch the conductor with it, I take away a little of the electricity. You see the spark in which it passes, and observe that the pith ball indicator has fallen a little, which seems to imply that so much electricity is lost; but it is not lost; it is here in this brass, and I can take it away and carry it about, not because it has any substance of its own, but by some strange property which we have not before met with as belonging to any other force. Let us see whether we have it here or not. [The lecturer brought the charged cylinder to a jet from which gas was issuing; the spark was seen to pass from the cylinder to the jet, but the gas did not light.] Ah! the gas did not light, but you saw the spark; there is, perhaps, some draught in the room which blew the gas on one side, or else it would light; we will try this experiment afterward. You see from the spark that I can transfer the power from the machine to the cylinder, and then carry it away and give it to some other body. You know very well, as a matter of experiment, that we can transfer the power of heat from one thing to another; for if I put my hand near the fire, it becomes hot. I can show you this by placing before us this ball, which has just been brought red hot from the fire. If I press this wire to it, some of the heat will be transferred from the ball, and I have only now to touch this piece of gun cotton with the hot wire and you will see how I can transfer the heat from the ball to the wire, and from the wire to the cotton. So you see that some powers are transferable and others are not. Observe how long the heat stops in this ball. I might touch it with the wire or with my finger, and if I did so quickly I should merely burn the surface of the skin; whereas, if I touch that cylinder, however rapidly, with my finger, the electricity is gone at once—dispersed on the instant, in a manner wonderful to think of.

I must now take up a little of your time in showing you the manner in which these powers are transferred from one thing to another; for the manner in which force may be conducted or transmitted is extraordinary, and most essential for us to understand. Let us see in what manner these powers travel from place to place. Both heat and electricity can be conducted; and here is an arrangement I have made to show how the former can travel. It consists of a bar of copper (Fig. 42); and

Fig.42



if I take a spirit lamp (this is one way of obtaining the power of heat) and place it under that little chimney, the flame will strike against the bar of copper and keep it hot. Now you are aware that power is being transferred from the flame of that lamp to the copper, and you will see by and by that it is being conducted along the copper from particle to particle; for, inasmuch as I have fastened these wooden balls by a little wax at particular distances from the point where the copper is first heated, first one ball will fall and then the more distant ones, as the heat travels along; and thus you will learn that the heat travels gradually through the copper. You will see that this is a very slow conduction of power as compared with electricity. If I take cylinders of wood and metal, joined together at the ends, and wrap a piece of paper round, and then apply the heat of this lamp to the place where the metal and wood join, you will see how the heat will accumulate where the wood is and burn the paper with which I have covered it; but where the metal is beneath, the heat is conducted away too fast for the paper to be burned. And so, if I take a piece of wood and a piece of metal joined together, and put it so that the flame shall play equally both upon one and the other, we shall soon find that the metal will become hot before the wood; for if I put a piece of phosphorus on the wood and another piece on the copper, you will find that the phosphorus on the copper will take fire before that on the wood is melted; and this shows you how badly the wood conducts heat. But with regard to the traveling of electricity from place to place, its rapidity is astonishing. I will, first of all, take these pieces of glass and metal, and you will soon understand how it is that the glass does not lose the power which it acquired when it is rubbed by the silk; by one or two experiments I will show you. If I take this piece of brass and bring it near the machine, you see how the electricity leaves the latter and passes to the brass cylinder. And again: if I take a rod of metal and touch the machine with it, I lower the indicator; but when I touch it with a rod of glass, no power is drawn away, showing you that the electricity is conducted by the glass and the metal in a manner entirely different; and to make you see that more clearly, we will take one of our Leyden jars. Now, I must not embarrass your minds with this subject too much, but if I take a piece of metal and bring it against the knob at the top and the metallic coating at the bottom, you will see the electricity passing through the air as a brilliant spark. It takes no sensible time to pass through this; and if I were to take a long metallic wire, no matter what the length, at least as far as we are concerned, and if I make one end of it touch the outside and the other touch the knob at the top, see how the electricity passes!—it has flashed instantaneously through the whole length of this wire. Is not this different from the transmission of heat through this copper bar (Fig. 42), which has taken a quarter of an hour or more to reach the first ball?

Here is another experiment for the purpose of showing the conductibility of this power through some bodies and not through others. Why do I have this arrangement made of brass [pointing to the brass work of the electrical machine (Fig. 41)]? Because it conducts electricity. And why do I have these columns made of glass? Because they obstruct the passage of electricity. And why do I put that paper tassel (Fig. 43) at the top of the pole upon a glass rod, and connect it with this machine by means of a wire? You see at once that as soon as the handle of the machine is turned, the electricity which is evolved travels along this wire and up the wooden rod, and goes to the tassel at the top, and you see the power of repulsion with which it has endowed these strips of paper, each spreading outward to the ceiling and sides of the room. The outside of that wire is covered with gutta-percha; it would not serve to keep the force from you when touching it with your hands, because it would burst through; but it answers our purpose for the present. And so you perceive how easily I can manage to send this power of electricity from place to place by choosing the materials which can conduct the power. Suppose I want to fire a portion of gunpowder, I can readily do it by this transferable power of electricity. I will take a Leyden jar, or any other arrangement which gives us this power, and arrange wires so that they may carry the power to the place I wish; and then, placing a little gunpowder on the extremities of the wires, the moment I make the connection by this discharging rod I shall fire the gunpowder [the connection was made, and the gunpowder ignited]. And if I were to show you a stool like this, and were to explain to you its construction, you could easily understand that we use glass legs because these are capable of preventing the electricity from going away to the earth. If, therefore, I were to stand on this stool, and receive the electricity through this conductor, I could give it to anything that I touched. [The lecturer stood upon the insulating stool, and placed

Fig.43

himself in connection with the conductor of the machine.] Now I am electrified; I can feel my hair rising up, as the paper tassel did just now. Let us see whether I can succeed in lighting gas by touching the jet with my finger. [The lecturer brought his finger near a jet from which gas was issuing, when, after one or two attempts, the spark which came from his finger to the jet set fire to the gas.] You now see how it is that this power of electricity can be transferred from the matter in which it is generated and conducted along wires and other bodies, and thus be made to serve new purposes, utterly unattainable by the powers we have spoken of on previous days; and you will not now be at a loss to bring this power of electricity into comparison with those which we have previously examined, and to-morrow we shall be able to go farther into the consideration of these transferable powers.

THE WAY FLORIDA WAS FORMED.

Considering that the naturalist of the present day finds the results of his predecessors' labors recorded in books, where he can acquire them in a small fraction of the time required by the original investigators to learn them from nature, it is probable that Louis Agassiz knows more about the plants and animals of the globe than any other person that ever lived. He has made a special study of the coral insects. We have read a very interesting account of the care with which he watched over some of the little worms which he had in his own room, for the purpose of observing their habits. Professor Agassiz is remarkable among geologists for his extreme caution in coming to conclusions. At the meeting of the American Association for the Advancement of Science, last summer, at Newport, R. I., his most earnest remarks were protests against drawing any inferences except those which follow by absolute necessity from the observed facts. This temper of mind, combined with his large acquirements, gives great weight to his assertions. Now, Agassiz says that the same kind of insects that are at this time forming the coral reefs of Florida, built up Florida, and that thousands of centuries must have been consumed in the process.

ARSENICAL WATERS.—A stream called Whitbeck, in England, rising in the Blackcombe mountains, in West Cumberland, contain arsenic in a determinable quantity. The arsenic is most probably derived from veins of arsenical cobalt ore, through which it percolates, for a few yards above the source there is the entrance of a mine which is very rich in arsenical ore. The arsenical water is habitually used for every purpose by the inhabitants of the little village of Whitbeck, and with beneficial results so apparent that one might be justified in paradoxically characterizing it as a very wholesome poison, the deadly elements in dilution being productive of the most sanitary effects. Ducks will not live if confined to the Whitbeck, and while trout abound in all the neighboring rivulets, no fins are ever found in the arsenicated stream. But its use by the villagers does not give rise to any symptoms of arsenical poisoning, but rather to the effects which are observed in Styria, among the arsenic-eaters there. When the railway was being carried past Whitbeck, the first use of the water produced the usual marked effects on the throats of the men employed on the works. The soreness of mouth, from which they at first suffered, soon, however, disappeared. The children of Whitbeck are celebrated for rosy cheeks, and many of the villagers live to a great age.

EXPLOSIONS.—We regret to notice the frequency of boiler explosions recently. On the 2d inst., the steamboat *H. M. Hill* exploded her boilers a short distance below Baton Rouge, on the Mississippi river, by which thirty-nine persons were killed and twenty wounded. A boiler in the coach factory of Dann & Brothers, New Haven, Conn., exploded on the 1st inst., by which one boy was killed and the building demolished. The tow-boat *Baltic* exploded her boilers in Mobile bay on the 3d inst., by which several persons (exact number unknown) were killed and wounded.

A correspondent of the Maine *Farmer* states that grass seed should always be sown in the Fall, and not in the Spring, as is practised by most farmers.

SOMETHING NEW ABOUT GOLD—A NEW METAL.

At a late meeting of the Manchester (England) Geological Society, an interesting paper was read by T. A. Readwin, Esq., on gold discoveries which had been made by him in Merionethshire, Wales, and he exhibited numerous rich specimens of ore taken from it. He stated that Sir R. Murchison had laid it down that "the most usual position of gold is in veinstones that traverse altered paleozoic slates frequently near their junction with eruptive rocks, whether of igneous or aqueous origin." This statement was remarkably corroborated by the position of the quartzose vein in Wales, which traversed altered paleozoic slates near the junction of an eruptive bar of porphyritic greenstone. The same law was found to hold good in all the gold-bearing quartzoze veins of Wales. Several shoots and bunches of gold were found in one mine. In one instance, 100 pounds of goldstone yielded 14½ ounces of fine gold. Lately, operations were commenced to mine the quartz upon what is called "St. David's lode." Of the rock which had been raised and broken, many stones were found very rich in gold and sulphides of copper, and there was another mineral which had been termed *white metal*, that had been examined by several mineralogists, none of whom knew what it was, an ignorance which was shared in by the members of the association after much examination. Cubes of this white metal were found in cubes of gold, and *vice versa;* and wherever it was found, it was a sure indication that gold was there also.

Mr. Readwin, in his paper, asserted that at a certain temperature gold would volatilize and escape mechanically, though such was not the general belief. Mr. Atkinson, a member, stated that gold was sublimated from the earth by internal heat.

NEW FUSIBLE METAL—CADMIUM.

Under this title, the New York *World* states that "Dr. B. Wood, of Nashville, has discovered a valuable alloy which fuses at 150° Fah.—a lower temperature than the fusing point of any metal previously known. It is especially adapted for light castings, and is composed of from one to two parts of cadmium, from seven to eight parts of bismuth, two of tin and four of lead. By the addition of mercury, the fusing point may be lowered to almost any extent without impairing the tenacity of the metal."

The old fusible alloy of bismuth, lead and tin melts at 197° Fah.; the cadmium in the above is stated to give it superior fusible qualities. When mercury is employed to render metals fusible, the compound becomes an amalgam, and not an alloy; and in every instance it impairs the tenacity of the metals. This is quite different from the opinion quoted above.

Cadmium is a metal which is but little known in the general arts, and there are comparatively few persons who have seen it. It is white in appearance, like tin—very ductile and malleable. It fuses considerably under a red heat, and is nearly as volatile as mercury. It is found in minute quantities associated with zinc; and in the distillation of zinc ores it comes over among the first products, owing to its great volatility. Cadmium forms several definite alloys; it unites with platinum and copper at a red heat. It is soluble in the powerful acids, especially nitric.

FALLING OF A GRIST MILL.—On the morning of the 3d inst., a portion of the Mount Vernon Mills, at Troy, N. Y., fell outward under a heavy load of 100,000 bushels of grain, about half of which was scattered among the ruins. The mill was only erected last winter, but good builders had pronounced it unsafe. The loss is $5,000, which might have been obviated by the previous outlay of $500 in the erection of stronger walls.

SAWING FEATS.—Referring to the great feat of sawing described on page 117 of the present volume of the SCIENTIFIC AMERICAN, Mr. Sturett A. Baird, of Marshall, Texas, informs us that the sawing of 1,000 feet per hour is held to be good work for the pine of that region. This he can do without leaving the mark of a tooth upon it. Southern pine is more close in the grain and more difficult to saw than the pine of the North.

A GREAT MACHINE FOR A SIMPLE PURPOSE—TURNING BAGS BY STEAM.

We have recently examined a machine more complicated than a stocking loom for the simple purpose of turning cloth bags (after they have been sewed or woven) the right side out! "Can it be," we asked the inventor, "that there is a demand for machinery for performing so trifling an operation as this?"

"Oh, yes;" he said, "it takes as much time to turn a bag as it does to make it, at the present day. In our neighborhood there are two large cotton manufactories devoted exclusively to making cloth for bags. In the country there are probably three hundred bag manufacturers, employing from two to fifty turners each, and one of these machines will do the work of thirty hands. One of the large manufacturers in this city told me that the machine, besides saving in wages, would enable him to effect considerable economy in his rent, from the small room occupied by the machine in comparison with all the hands he now employs for turning."

The machine works in the most accurate, rapid and beautiful manner, but it would be difficult to give any clear idea of its ingenious mechanism without diagrams. An application for a patent for the invention has been made through the Scientific American Patent Agency, and probably our readers will hear more of it at some future time.

HOW TO SWIM IN A SURF.—At a late meeting of the Chicago Academy of Sciences, one of the members, in the course of a discussion, gave the following very useful information for persons who may be shipwrecked or who happen to fall overboard at sea:—"The person must maintain such a position as to see the waves as they approach. All that is required, then, is that the swimmer keep his course, watching their approach. As he rises upon a wave, he will see a roaring cataract three or four feet high rushing toward him as though it threatened destruction; but if he holds his breath a moment, the crest will pass harmless over him, and in an instant he will find himself on the windward slope of the wave, perfectly safe and ready to continue as before. If the person is floating upon a board or plank, he should turn his head toward the coming waves and keep his float at right angles to them, holding his breath as before when the crests pass. In this way he will be safely driven to the beach; but if he allows the board to be struck by the waves sidewise, he may be rolled over and over, and, in his fright, let go his hold."

FROM some very interesting experiments made by Professor L. Vella, of Turin, we are led to conclude that the poison *curare* is an antidote to strychnine. That a mixture of these two deadly poisons so far from increasing in virulence becomes innocuous, and may be administered to animals with impunity. Signor Vella was led to try this experiment by considering the property possessed by curare of paralysing the motor nerves, and to apply it to the cure of tetanus, a disorder essentially convulsive. Curare completely destroys the effects of a dose of strychnine, which is mortal when administered either by the stomach, or by injection, or injected into the veins. In a physiological point of view this fact is important, for it serves as a scientific basis to all the applications of curare that can be made in therapeutics.

CONVERTING WAR SHIPS INTO STEAMERS.—The Board appointed by the Secretary of the Navy to examine what ships of the navy may be converted into steamers report that they have found it inexpedient, owing to their small capacity and various other considerations, to recommend any but the following line-of-battle ships: *Pennsylvania, Columbus, Ohio, North Carolina, Alabama, Virginia* and *New York.* The other two—the *Delaware* and *New Orleans*—are unfit, both in frame and planking, for this alteration. The entire cost of converting these ships, according to their estimate, will be about $3,064,000.

THE cultivation of the silk worm is said to be a complete success in California. Specimens of cocoons, floss and twisted silk were exhibited at the late Mechanics' Fair in San Francisco. California is yet destined to become a great wine and silk-producing State.

IMPROVED CONNECTED STEAM TRAIN FOR MANUFACTURING CHOICE BROWN SUGAR FROM CANE JUICE.

In order that the object and nature of this invention may be fully understood, before describing it reference will be made, as briefly as possible, to the different apparatuses for, and methods of, evaporating cane juice heretofore used, and their defects explained.

Notwithstanding the various and multiplied mechanical appliances used in sugar making, there are but two methods of evaporating cane juice, viz: one by the direct application of fire or flame to kettles, and the other, by the introduction of steam into pans either open or in vacuo. The apparatus for refining is very expensive, and within the reach of large capitalists only; hence it has been adopted by but few—the great body of planters being engaged in the manufacture of the ordinary brown sugars.

In what is known as a "kettle train," employed in the first mode, the smallest kettle, termed the "battery," is situated immediately over the fire, and the largest one, known as the "defecator," is furthest from the fire. As the cane juice comes from the mill, it is directed into the defecator, where lime is added for its defecation. After being boiled and scummed, it is passed forward from one kettle to another in the train tion varies with the nature of the cane juice. It must be sufficient to effect perfect defecation or very little in excess; and to maintain this point uniformly requires great skill and care on the part of the sugar maker.

In all the arrangements of kettles or pans heated by the direct action of the fire or flames, it is found practically impossible to preserve an equal temper of the cane juice from the fact that after the juice has been limed in the defecator, boiled and scummed, it has to be passed forward with dippers or buckets to the next pans or kettles of the set for further evaporation and cleansing, and in doing so, more or less of the tempered juice must be left in the defecator, it being impossible to thoroughly empty it.

It frequently happens at night or at other times when the attendants are sleepy or careless, that a larger quantity than usual will be left, and on the defecator being filled up with raw juice and having the usual quantity of lime added, the liming or temper will be in excess or too high; and if the same thing should be repeated, the trouble will be increased in the next charge, and considerable damage is thus often occasioned to the quality of a large quantity of sugar. This excess of lime gives a dark color to the sirup, which can only be removed from it by filtration through animal charcoal or bone black.

its foreign matters. In boiling in kettles which are always on the same level, this difficulty is remedied at once by the addition of some less concentrated juice from the next or one of the kettles further back in the train; this being done, ebullition starts afresh and the cleansing process goes on as before. In the open steam train, as heretofore arranged, with the pans isolated, no convenient provision is afforded for this transfer of the juice, and in consequence, the albuminous impurities remain, and when the sirup is concentrated to the sugar point in the battery, nothing but a pasty and deliquescent sugar is obtained.

To get rid of the imperfections remaining in the sirup resulting from the process described, some manufacturers resort to the use of "settling tanks," where the sirup is accumulated in large quantities, to undergo by repose a natural subsidence of its impurities. The density of the sirup best suited for this purpose is 27° or 28° Baumé, and the subsidence proceeds best while the sirup is hot. From the length of time required (24 to 72 hours) and the increased density of the sirup owing to the loss of heat, the subsidence proceeds but slowly, and changes in the composition of the sugar inevitably ensue; these changes are produced even in the purest sirups, when thus treated, but they take place more rapidly and to a greater extent when the sirup holds in

Fig. 1

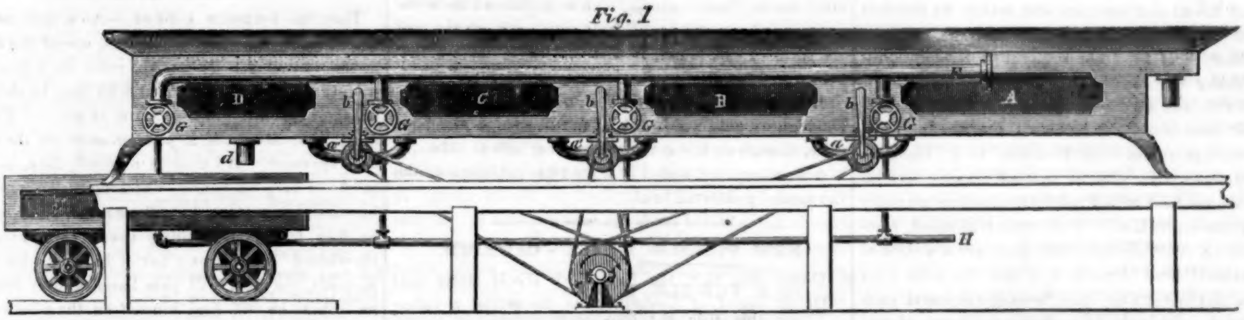
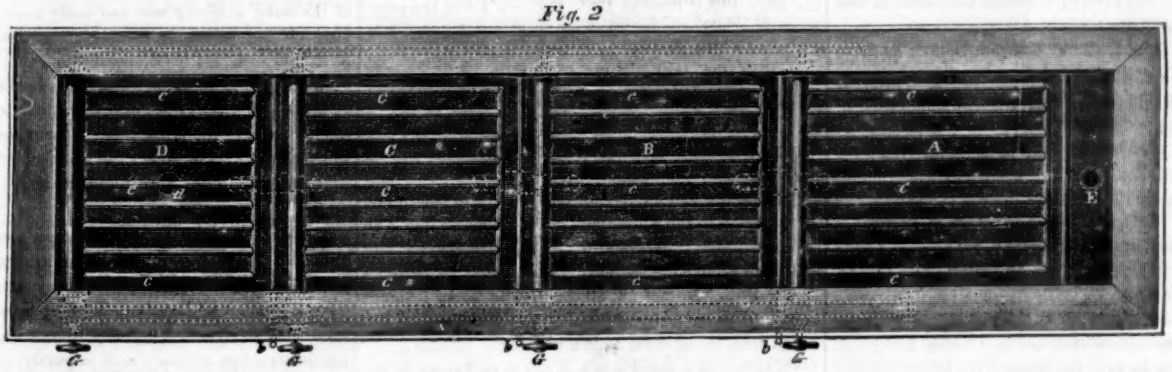


Fig. 2



GILBERT & AMES' CONNECTED STEAM TRAIN FOR MANUFACTURING "CHOICE" BROWN SUGAR FROM CANE JUICE.

for further evaporation and cleansing, till it reaches the battery in which it is concentrated to the sugar point, and from which it is discharged into the coolers.

With the use of the kettle train the amount of fuel consumed is enormous, varying from $2\frac{1}{2}$ to 5 cords of wood per hogshead of sugar made, according to the state of the cane—a quantity much greater than is necessary to produce the amount of evaporation demanded. There is also required for every kettle a hand to attend to the "brushing-off" of the scum, and in bucketing the juice from one kettle into another, which is very laborious work. Considerable loss occurs by the leakage of the juice through the tiling, even when the kettles are set on the most approved plan, as well as in "water strikes," by the temporary stoppages of the working of the train. A large percentage of the sugar is lost by being burnt in emptying each "strike," the crystallizing power of which, being impaired, drains off from the crystallized sugar into the sugar as molasses, as also in the process of cleansing the battery by burning, which must be done at least every third or fourth day. The loss by this means upon each crop of sugar taken off in open kettles is at least five per cent. But the ill effects of this constant burning manifest themselves not so much in the loss in *quantity* as in the injury to the *quality* of the sugar which so much depreciates its market value.

The proper quantity of lime or "temper" for defecation

It has been attempted to obviate this imperfection by defecating the cane juice in separate pans heated by steam and isolated from the kettle train; by this, only a partial amelioration of the result is effected, for the juice still has to be bucketed from kettle to kettle, to keep them all full, or nearly so.

The open steam train has been adopted to a considerable extent, as an improvement on the kettle train.

In the ordinary open steam train, the pans are placed at different levels, the defecator the highest, and the others successively lower, the battery being the lowest, and the juice is completely discharged from one pan to another by gravitation.

In operating the train, the cane juice, after being defecated, is conveyed directly into the evaporator, and is there subjected to the triple process of evaporation, cleansing and concentration, all of which must go on at the same time. That these important operations should be performed at the same time and in the same vessel, without serious injury arising in one or other of the processes, is impossible, and experience has proved that it is so. But while, by this apparatus, a perfect defecation can be maintained, the subsequent treatment of the juice in the isolated pans is unfavorable to the perfect cleansing of its impurities; the reason of this is as follows.

After cane juice has reached a certain density in boiling, it becomes thick and viscid, and ceases to throw off

solution those organic substances which are found in cane juice. Sirups thus treated, when concentrated to the sugar point, produce gray sugars—sugars in many cases inferior in quality to those made in kettles.

In fact, the manufacture of sugar by the ordinary open steam train is so defective that most manufacturers who have adopted it, have been compelled to resort to the use of bone black, vacuum pans, centrifugals, or other remedial processes, to obviate the radical defects of its arrangement, as a means of obtaining sugar of good quality.

The object of this invention is to so construct and arrange an open steam train as not only to provide for the perfect defecation of the juice in the defecator, but to obviate the above-mentioned defect of the ordinary steam train, and to this end the invention consists of the connected steam train, which is described as follows:—

Fig. 1 is an elevation of the connected steam train.

Fig. 2 is a plan of the same.

Similar letters of reference indicate corresponding parts in both Figs.

A B C D are the pans, represented as consisting of the same long, open tank, but they may be otherwise arranged side by side at the same level, so as to constitute a continuous train, the largest pan, A, which is the defecator, being at one end of the train, and the small-

est one, D, which is the battery, being at the other end; the others being arranged intermediately.

At the end of the defecator there is a trough, E, for the reception of the scum gathered from the juice in the defecator. In the lower part of the partition, between the defecator and the pan, B, there is a slide valve, *x*, which may be opened to allow the juice to be discharged from the defecator into the pan, B.

Steam is furnished to the evaporating pipes, *c c c*, within the several pans, by branches from the main pipe, F, which leads it from the boilers. Cocks or stop valves, G, are fitted to the steam pipes so that the steam can be shut off from either pan without interfering with the others. The water from the condensation of the steam in the several pans is carried back to the boilers by the pipe, H. In the battery is a discharge cock or valve, *d*. J is the strike box.

Rotary pumps, *a a′ a″*, for passing the juice forward from one pan to another of the series, as the process advances, are arranged one under each of the divisions between the pans, A B C D: the discharge pipe from each pump leads forward to the next pan in the series, so that the contents of the defecator, A, may be discharged into B, those of B, into C, and those of C, into the battery, D.

Motion is communicated to these pumps by belts on the pulley, *e*, and the loose friction pulleys on the rods operated by the handles, *b b b*.

The operation of the train and treatment of the juice are as follows:—

In starting, the defecator, A, is charged with raw juice from the mill or juice boxes: the steam is let on, and when the juice has attained a temperature of about 150° Fah. the proper dose of lime for its defecation is added. As the heat of the juice increases, the albuminous matters rise to the top with many impurities in the form of scum, which is skimmed back into the trough, E, and there allowed to settle.

As soon as the juice has been properly defecated, the slide valve, *x*, is opened and the defecated juice allowed to run into pan, B, until the proper quantity is obtained, when the said valve is closed. Steam is then let on to pan, B, and the boiling and cleansing process begins therein and the impurities, as they rise, are brushed back into the defecator, and from thence into the trough, E. After the juice has been boiled a short time in the pan, B, it is discharged by means of the pump, *a′*, into the pan, C, and the pan, B, is replenished from the defecator, either through the slide valve, *x*, or the pump, *a*. Steam being then let on to the pan, C, the cleansing process proceeds therein as it previously did in B. As the juice in the pan, C, becomes thick and viscid, and does not readily throw off its impurities, a sufficient quantity of less concentrated juice is passed forward to it from the pan, B, and ebullition is increased and the cleansing proceeds again actively. The impurities as they rise in C, are brushed back to the pan, B, and from thence to the defecator, and thence to the trough, E.

When the juice has been properly cleansed of its mucilage and other impurities in the pan, C, it is passed forward to the battery, D, by the pump, *a″*, where it is concentrated to the sugar point, and whence it is discharged by a cock or valve, *d*, in the bottom, into the strike box, J. As soon as the sugar in the battery has been discharged into the strike box, the battery is recharged with sirup from the pan, C, by the pump, *a″*, and that pan replenished from the pan, B, by the pump, *a′*; from the defecator, A, by the pump, *a*, or valve, *x*; and the defecator, as soon as it is completely emptied, *and not before*, is again supplied from the juice box or mill, and thus the rotation is continued, the pans, A B and C, clarifying and preparing the juice for the battery, D.

It will be observed that in the process performed by this apparatus, the proper point of liming can always be maintained, from the fact that the whole of the juice so defecated in the defecator, A, is passed forward into the other pans of the series in succession, without any admixture with the raw juice, consequently giving to the sugar maker the means and facility of keeping an uniform temper in the cane juice from the beginning to the end of the crop; and from the defecator to the battery, the cane juice is treated continuously as a boiling mass, whereby a perfect separation of the albuminous principle can always be maintained before the sirup is concentrated to the sugar point in the battery, and hence are obviated the imperfect defecation caused by the too high liming of the juice, as in the ordinary fire or kettle train, and the imperfect clarification and cleansing of the juice, as in the isolated pans of the ordinary open steam train; as the result of this process, the finest quality of brown sugar that can be made is obtained.

Besides the improved result thus obtained by its use, there are other advantages in the working of the connected steam train, to wit: Its management is so extremely simple that *one-half* the attendants required to work other apparatuses are, in this arrangement, dispensed with; the duties of the attendants are rendered very light, for the labor of bucketting is dispensed with, and by "foaming" the pans but little brushing is needed to cleanse the juice completely.

Constant intercommunication can be kept up between the pans, and the juice can be thrown at will from one pan to another, to facilitate the cleansing, as it becomes thick and viscid.

The operation of the train can be expedited or retarded at pleasure, as it is always under the complete control of the sugar maker.

The connected steam train also economizes both time and fuel, it being evident that the necessary manipulation from one pan to another can be performed more expeditiously, and the loss of heat which attends the process in other apparatuses is obviated.

A crop of 515 hogsheads of sugar, made upon the principles embraced in this invention, classed as "choice"—the highest grade of brown sugar known in the New Orleans market, and commanding the highest price.

A working model of this train was exhibited at the Louisiana Industrial Fair, held at Baton Rouge in March last, where a certificate was awarded it "as possessing great facilities for making sugar, and having advantages over any other on exhibition and worthy a first premium."

Three sizes of these trains are manufactured, of the capacity to make 10, 15, and 20 hogsheads of sugar each, per day. As these trains are simple in construction, dispensing with the use of isolated clarifiers, settling tanks, bone black, vacuum pans, centrifugals, and other expensive paraphernalia heretofore required in connection with the ordinary train, they can be furnished to planters at very reasonable prices.

Messrs. Merrick & Sons, Philadelphia, are the authorized agents and manufacturers, to whom inquiries for information can be directed to their office, No. 36 Camp-street, New Orleans, or to either of the patentees.

The patent for this invention was granted to W. H. Gilbert, of Bayou Goula, and H. O. Ames, of New Orleans, La., on June 5th, 1860, through the Scientific American Patent Agency.

CHLORINE.

The value of chlorine to arts and manufactures rests principally upon its power to bleach or destroy color; and by its means, the manufacture of linen and cotton goods has been very much improved.

Chlorine was discovered by the celebrated Charles William Scheele, a Swedish chemist, during the latter part of the last century. Chlorine is so energetic that, if let loose upon the world, it is sure very quickly to unite with some one body or another; hence we never find it on the face of the earth in its primitive condition. Again, nearly all the compounds of chlorine are soluble in water; hence rain dissolves them out of the soil, and thus they pass by running streams, brooks and rivers into the sea, where they are found in great abundance.

The most notable compound of chlorine is the table salt of domestic use, which consists of 23 parts of a beautiful soft metal, called sodium, and 35 parts of chlorine, both of which can be separated from one another, and exhibited in their natural beauty. When chlorine is isolated, it takes the form of a vaporous gas, having a greenish yellow color; hence Sir Humphrey Davy gave it the name of chlorine, from the word *chloros*—light green.

A compound of chlorine and potash is most extensively used in the formation of friction matches. How much these household trifles add to our daily comfort all can tell.

In crowded hospitals, in dark and dank places, where the matter of infectious miasma lurks, a little chlorine set free destroys the arch enemy on his own ground; hence chlorine is a most powerful disinfectant, and for this important discovery Dr. Carmichael Smith received from the English Parliament a large grant of money.

Chlorine gas is extracted from common salt thus: Place into a retort two ounces of salt, one and a half ounce of black oxyd of manganese, two and a half ounces of water; shake these together; then add gradually one and a quarter ounce of concentrated sulphuric acid, and boil the mixture with a gentle heat, and collect the chlorine gas that is generated in a jar over a pneumatic trough filled with warm water. In this state it has a suffocating color, and is very irritating to the trachea or throat valve; thus, wherever it is made, good ventilation is necessary.

There are many other compounds of chlorine used in chemical arts besides those named, such as hydrochloric acid, which consists of hydrogen and chlorine, and being mixed with nitric acid dissolves gold. It also enters into the manufacture of medicines, particularly of calomel. Thus have we shown briefly some of the uses of chlorine. It is but one, however, of a family of four similar bodies, all of which are to be found in the ocean.

SEPTIMUS PIESSE.

GREAT CHURCHES.

The following is a table of the capacity of several large European churches, in which a square yard is allowed for four persons:—

	Persons.	Sq. yards.
St. Peter's, Rome	54,000	13,500
Milan Cathedral	37,000	9,250
St. Paul's, Rome	32,000	8,000
St. Paul's, London	25,600	6,400
St. Petronio, Bologna	24,400	6,100
Florence Cathedral	24,300	6,075
Antwerp Cathedral	24,000	6,000
St. Sophia's, Constantinople	23,000	5,750
St. John Lateran	22,900	5,725
Notre Dame, Paris	21,000	5,250
Pisa Cathedral	13,000	3,250
St. Stephen's, Vienna	12,400	3,100
St. Dominic's, Bologna	12,000	3,000
St. Peter's, Bologna	11,400	2,850
Cathedral of Sienna	11,000	2,750
St. Mark's, Venice	7,000	1,750

The piazza of St. Peter's, in its widest limits, allowing twelve persons to the square yard, holds 624,000; allowing four to the same, drawn up in military array, 202,000.

CELL LIFE.

[Prepared expressly for the Scientific American.]

Nature has taken upon herself so many and such varied forms, that it will be a rather startling assertion to unscientific readers to learn that all these, either as animals; from man down to the monad; or as vegetables, from an oak tree to a confervoid, are derivable from, and make their first appearance as, a minute mass of matter of a somewhat spherical form, and termed a cell.

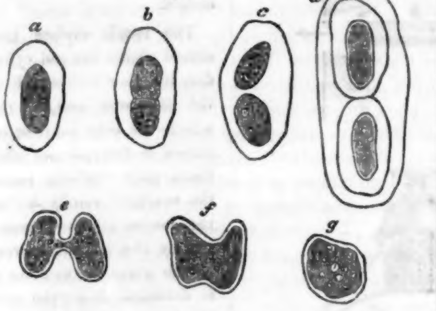
If we are ever destined to solve the great problem to know what is life, it will undoubtedly be on the border land of Nature, where her two great kingdoms of animal and vegetable existence seem to approach each other—that there we shall make the first footsteps which shall eventually lead to the nearest relation to supreme wisdom that man shall be ever permitted to attain. It is this feeling, acknowledged or unacknowledged, that has ever acted as the spur to the investigating mind o the naturalist, and it is the knowledge of the existence of the power of learning that has secured for the patient student of Nature the respect of unscientific minds, and persons who could see no direct advantage to be gained from his painstaking search after that philosopher's stone of life which would make him feel that "knowledge is power." Perhaps no class of phenomena has excited a greater wonder, a purer joy, a sublimer interest among those who have been permitted even to catch a glimpse of them than the almost boundless field of discoveries which are revealed to us by the aid of the microscope, and the interest which they engender is due in no small degree to the fact, that they alone hold out any promise of ever leading us to a knowledge of the *beginning of life*.

We intend herein to give a comprehensive sketch of the primary forms of life in the vegetable and the animal, and any statements given may be implicitly relied on as being in accordance with the very latest

developments of the microscope as applied to natural science.

The first indication of life, be it animal or vegetable, is found in the simple cell—a somewhat spherical sac, varying in size, but mostly so small as to be invisible to the unassisted vision, but which, when examined by means of the microscope, is found to have undeviating characters. Yet, strange to say, in this simple form the vegetable cannot be distingushed from the animal. The lower orders of both kingdoms, consisting of single celled organizations, are so similar in outward appearances

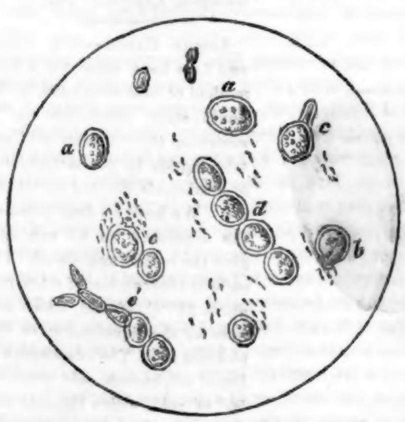
Fig. 1



that they have been often confounded, so that what were once considered whole familes of animals, principally on account of their possessing individual motion, have been now found to be but different states of plants of larger growth.

As a simple example of a single celled plant, we may take the green slime which is sometimes seen spread over damp stones, walls, &c. If a small portion of this be examined under a microscope, it will be found to be composed of a multitude of green cells, each surrounded by a gelatinous envelope, *a*. After a while these are found to become elongated, and at last a contraction is found to take place across the middle portion, *b c d*. This goes on until, at last, each cell becomes two, thus presenting us with a good example of that curious multiplication by duplicative sub-division, which is the mode in which increase nearly always takes place throughout the vegetable kingdom. This is the mode of growth of this plant, but its generation is totally different, yet, at the same time, equally simple. It consists in the union or fusion of two cells—a process which is termed conjugation, and takes place in many other plants. This process is seen in the figure *e f g*. A bridge is first formed between two adjacent cells, which at last coalesce into one large cell. The contents of this then become pasty and sub-divide into new cells.

This plant does not present to us the motile form which is seen in many plants, but our friend the yeast plant shows it in a striking manner. This is first presented to us as a number of spherical cells, as seen in



the figure *a a*. After some time a swelling is seen to take place on one side of the cell, where an opaque spot, called a nucleus, is seen, *b*, and as this growth is continued, there is formed a kind of bud, as shown at *c*. When this bud becomes of the size and form of the parent cell it also pushes out a bud, and the process continuing, a row of cells is formed, as at *d*. The number of these cells in a chain varies as does the size and form of each individual cell. Each one is found to have, somewhere on its wall, the small spot mentioned above, and called the nucleus, which is the starting point for the new cell; and if two of these nuclei are present, as is sometimes the case, two new cells are simultaneously formed, springing from the first or *sporule* stage.

Up to this point the sugar or nitrogenous matter in the liquid undergoing fermentation is being metamorphised into new *matter*—alcohol, carbonic acid and water. To make this clearly apparent we may express it by the use of chemical symbols, as follows. Sugar is composed of twenty-four atoms of carbon, twenty-eight of hydrogen and twenty-eight of oxygen, and is written thus, $C_{24}\ H^{28}\ O^{28}$. The change which takes place during fermentation is thus shown:—

One atom of sugar, $C_{24}\ H_{28}\ O_{28}$, becomes
$C_{16}\ H_{24}\ O_8$ = four atoms of alcohol.
$C_8\quad O_{16}$ = eight atoms of carbonic acid.
$H_4\quad O_4$ = four atoms of water.

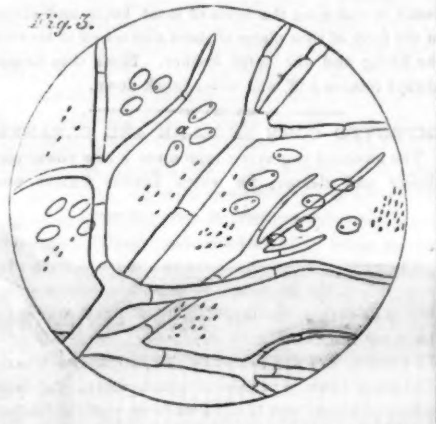
So that when we find the yeast plant about to pass from its first into its second stage, we may be sure that fermentation is complete. Brewers being aware of this fact, and having no further use for the plant, arrest its growth at this point by raising the temperature of the liquid.

The second or *thallus* stage makes its appearance after

Fig. 2

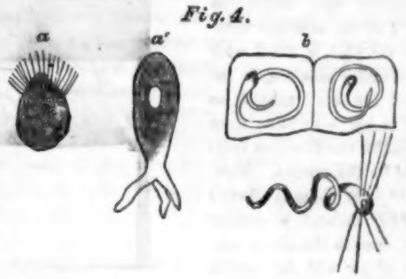
a few days, under favorable circumstances. The cells or sporules become much elongated. A division or partition forms across each, so that two cells are now formed from one and (this process of sub-division continuing) jointed threads make their appearance—at first simple and undivided, and afterwards branched—and the plant now exists in the state of a root or *thallus*. This takes place at or near the surface of the liquid in which it is growing.

Fig. 3.



The yeast plant has up to this point been growing; it now begins to reproduce. The third or *fructification* stage is never seen in fermented liquors, from the reason we have given above. Indeed, it had hardly been seen until Hassall experimented on the yeast plant. When it begins to appear, jointed threads shoot up from the root and become branched; each branch at last bearing upon its extremity a row of rounded and beaded corpuscles, which are about the size of, or perhaps mostly a little larger than, the sporules seen during the first stage, but differ from those bodies by becoming, after a time, opaque and firm in texture. This portion of the life of the yeast plant is somewhat obscure; but it would seem that from some of these corpuscles come forth the seeds, which cannot fructify and grow until they have been impregnated by the antherozoids, which are ejected from other cells. This mode of reproduction has not been positively ascertained to take place in the yeast plant, but it has been seen in nearly allied vegetables. In the figure, the cells containing the seed are seen at *a*, whilst the antherozoids are represented at *b*. These little antherozoids are remarkable from possessing separate individual motion, swimming about vigorously by means of certain hair-like organs attached to one end; and this motion seems so plainly to indicate separate life that they have again and again been taken for animals. The yeast plant is not the only vegetable which exhibits them, but during their fructification they make their appearance in many others, always possess much the same characters, being spiral threads furnished with one or more hair-like appendages, termed *cilia*, as motatory organs. The seeds, or spores, as they are sometimes called, have often motion almost as vigorous as the antherozoids, and produced in the same manner. In Fig. 4 are shown both these organs

Fig. 4.

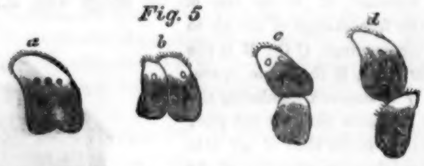


as seen in a larger water plant, *a* being the spore in motion, *a′* the same at rest; *b* the antherozoids in the cells of the plant, and *b′* the same free and in motion.

We can easily understand from the above description of the yeast plant how, from a single cell, may be formed a large, many-branched plant or tree; such an organism being but an accumulation of cells of different forms and structure, as any one can satisfy himself by a careful examination of any vegetable tissue by means of a microscope. But there are other single celled organisms which differ completely in their characters from vegetables, and it is often difficult to distinguish them therefrom. It is only from a careful study of their habits and life that we are enabled to rank them with animals. There are many large and widely distributed groups of organisms which have at different times been bandied backwards and forwards between the vegetable and animal kingdoms; it is but the other day that a large group of what have been hitherto considered distinct plants have been placed by a French naturalist in the animal kingdom.

A good example of a single celled animal is found in one of the little masses of flesh which are so common in stagnant and other water. It is called *chilodon cucullulus*, and its reproduction is effected in a curious manner; very much after the mode of that of the green spoken of above. The animal moves about in the water by

Fig. 5



means of cilliæ placed at one extremity of its body. When reproduction takes place the body sub-divides either longitudinally, *a* and *b*, or transversely, *c* and *d*, each half becoming a separate and complete animal. This operation is performed with such rapidity, under favorable circumstances, that, according to the calculation of Professor Ehrenberg, no fewer than 268 millions might be produced in a month by this repeated act of sub-division.

Thus we see that sub-division of cells constitutes the mode of growth in the lower orders of animals, and the same rule holds good in higher orders; there being this striking resemblance between the two kingdoms. In animals, however, the primary cell form becomes more effectually obliterated than in the larger plants, the larger vessels and some of the tissues not presenting the cell in as perfect a condition as in the plant.

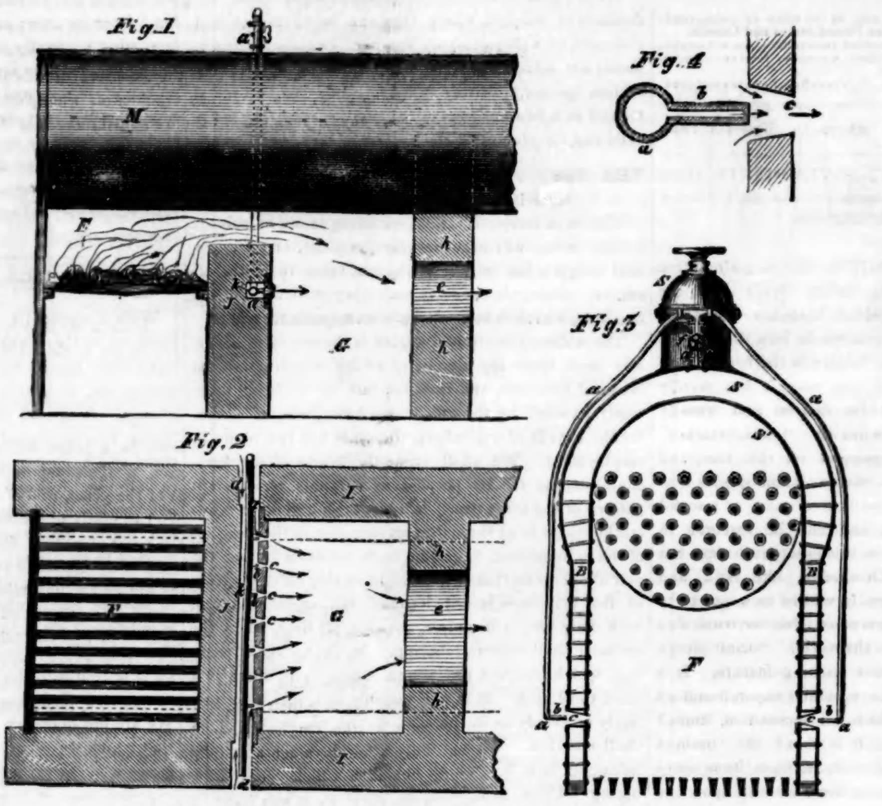
The microscope has been of great service in the study of lower as well as the higher order of animals, and out of its application to the study of the latter has grown a science—that of histology—of infinite value to the anatomist and the medical man, and thus to all mankind.

A. M. E.

IMPROVED APPARATUS FOR THE COMBUSTION OF SMOKE IN STEAM BOILER FURNACES.

It is well known that in most furnaces of steam boilers a large part of the fuel escapes in the form of sparks, particles of carbon, carbonic oxyd, &c., without being consumed, in consequence of an insufficient supply of oxygen to the furnace; and many plans have been tried for furnishing the additional supply of air requisite for perfect combustion. We here illustrate a device for blowing currents of air into the furnace of a steam boiler, by the curious principle that is called the principle of Venturi. This principle is illustrated very clearly in Fig. 4 of the annexed cuts. Into the pipe, *a*, filled with steam under pressure, is inserted the small tube, *b*, so that steam may issue from its end in the direction indicated by the arrows. Now, if this jet of steam is allowed to flow through a conical tube, open to the air, a current of air will be carried along by the stream of steam in the same direction with itself.

D. H. Williams, of Pittsburg, Pa., has invented an apparatus by which this property of a jet of steam is made available for introducing a blast of air into the furnace of a steam boiler. This apparatus is represented in the annexed engravings. Like letters refer to like parts in all the figures.



WILLIAMS' IMPROVED SMOKE-BURNING APPARATUS.

M is the boiler; I I are the side walls inclosing the boiler, boiler furnace, &c.; F is the furnace, showing also the grate bars; G is the combustion chamber formed by the side walls, I I, the bridge wall J, and the heat-retaining wall, *h*; the heat-retaining and deflecting wall *h*, has a flue or opening, *e*, for the passage of the products of combustion; *a* is the steam pipe by which the steam is conveyed from the boiler, M, to the nozzles, *b b* (with one-twentieth inch holes), which are arranged external to, and concentric with the air openings, C C; *d d* are the passages through the walls, I I, to the air chamber, *k*, in the rear of the bridge wall, J, for the free passage of the air to the air openings, C C; B is the water space, S the steam space, and *f* a stopcock regulating the flow of steam through the pipe, *a*, and thus the blast of air into the combustion chamber of the furnace. After the steam is raised in the boiler, if the stopcock, *f*, is opened, jets of steam will issue from the several tubes or nozzles, *b b*, and rush into the combustion chamber, G, carrying with them in their passage through the conical openings, C C, currents of air, on the principle of Venturi, as has been explained.

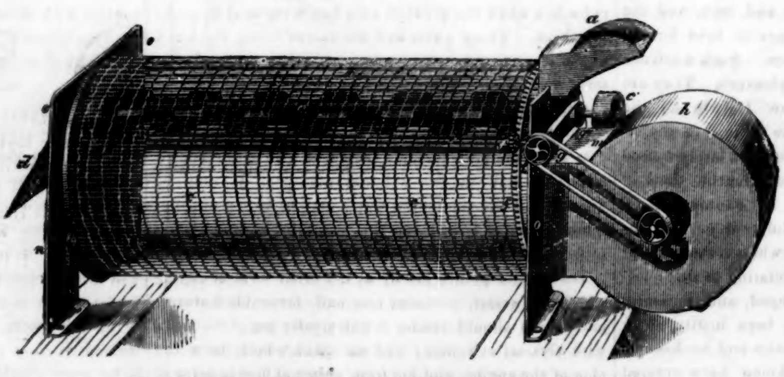
It will be seen that the currents of air into the chamber being numerous, the air is distributed very thoroughly among the unburned portions of the fuel, completing the combustion in the most effectual manner. The owners of the patent say that experiments have shown a saving of 20 per cent of the fuel by the use of this apparatus, which is applicable to either stationary or locomotive engines.

The patent for this invention was issued on May 15, 1860, to David H. Williams and R. B. Fitts, assignees of the inventor, and further information in relation to the same may be obtained by addressing R. B. Fitts, at No. 609 Sansom-street, Philadelphia.

Artificial Leather and Shoes.—At Amherst, Mass., artificial leather is made of a mixture of sawdust, chopped flax, tar and waste paper, mixed with gutta percha. This article is used for stiffenings in shoes, and, to some extent, for inner soles. It is certainly much superior to the stiffenings of coarse brown paper, which was formerly used in cheap Eastern shoes. A very good improvement has recently been produced in stiffening the heels of stout boots and shoes, in the form of thin plates of sheet zinc sewed in between the lining and the outer leather. Heels thus formed always remain stiff, and never break down.

IMPROVED CORN SHELLER AND CLEANER.

The annexed engraving represents a new power corn sheller and cleaner, for which Letters Patent were granted to Messrs. Hubbler, McGrath and Richards, of Lafayette, Ind., on Sept. 5, 1860, and which, judging from the testimonials of parties now using them, is far superior to other shellers now in use. Messrs. Spears & Hardy, of Lafayette (one of the largest grain firms in the West), state that they have shelled 300 bushels per hour with one of these machines, now in their warehouse, and that they are confident they can shell 5,000 bushels per day. Many others speak practically of their superior advantages.



IMPROVED CORN SHELLER AND CLEANER.

The great desideratum in corn shelling seems to have been attained in this machine, as it shells rapidly and perfectly clean, whether the corn is wet or dry, and delivers the grain in a sound and unbroken condition.

The corn is introduced through the hopper, *a*, to the cylinder, B B, which is constructed of rods of wrought iron (as shown by the dark lines), placed at such distances apart as to admit of the free egress of the shelled corn between them at any point. An iron cylinder, *c*, with broad flat teeth, rotates concentrically within the cylinder of rods, operated by pulley, O, and as the corn is fed in at *a* the cobs are forced out at the discharge end, *d*.

The rough surface presented within the rod cylinder, together with a slide in the discharge end, *d* (by which the cobs may be retained in the cylinder until thoroughly shelled), places the machine wholly within the control of the operator; and by the instant delivery of the grain the moment it is detached from the cob, all danger of its being cut or ground is effectually obviated, and the cylinder also kept free and clear from obstructions.

The cleaner attachment is also perfect in every part, consisting of a cylindrical screen, *e e*, surrounding the rod cylinder, and slowly rotating by means of the cog gears, *f* and *f*, driven by pulleys, *g* and *g'*. The shelled corn is constantly agitated by the rotation of the screen, whilst a blast from the fan, *h*, driven by pulley, P, and gear wheels, *p* and *p*, enters the screen at *m* and forces the chaff and dust out at *n*, with the cobs; thus effectually cleaning the corn, which falls through the screen to the floor. A sheet iron cap or jacket covers the screen. The entire machine is constructed of iron and firmly set within a frame, *o*, of like material, thus combining efficiency with durability in the greatest possible degree.

Every machine is warranted to perform as recommended, and all orders will be promptly supplied by the patentees and manufacturers, Hubbler, McGrath & Richards, Lafayette, Ind.

Liquid Gases.—MM. Drion and Loir have suggested a new method of obtaining gases in the liquid state, which consists in hastening the evaporation of certain liquids by the introduction of a minutely divided current of air. We have no description of the apparatus, so we can only give the results announced. The sudden evaporation of ether produces 34° C. of cold, which suffices for the liquefaction of sulphurous acid. The evaporation of liquid sulphurous acid produces 50° of cold, which liquefies ammoniacal gas. Liquid ammoniacal gas instantaneously vaporised gives 65° which will liquefy carbonic acid, and carbonic acid vaporised in the same way gives 87° of cold. By means of the cold produced by the evaporation of ether, the authors liquefied the carbonic acid obtained by heating bi-carbonate of soda in a sealed tube; and they proved that, when the action of the cold was discontinued, the acid re-combined with the soda. They also proved that, at very low temperatures, chemical combinations did not take place, for instance, at 67° sulphurous acid did not unite with ammonia.

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VOL. III., No. 21....[NEW SERIES.]....*Sixteenth Year.*

NEW YORK, SATURDAY, NOVEMBER 17, 1860.

A NEW SCIENCE.

KNOWLEDGE is like a grafted tree whose roots strike deeply into the past, and whose branches extend upwards and outwards into the present and future. Science is the fruit of this tree, and of late years it has rapidly multiplied in variety and greatly improved in quality. "Social science" is a new fruit which has appeared on this tree, and it promises to be one of the most valuable species that hangs upon its bows. The welfare of man, as a social being, should be the aim and end of research in science and art; but hitherto this great truth has not been duly appreciated. Knowledge, like rank and wealth, has been most generally viewed as a power to be employed for ambitious purposes; but we trust that a better era is dawning upon the world. Social science differs from every other in one striking feature. It is not like mechanics or chemistry, which expand and are sub-divided into branches with an increase of knowledge; but, on the contrary, it lays all the common sciences under tribute and collects facts from every source, so as to bring them to bear directly upon the welfare of man as a social being. The devotees of this new science have a particular organization, which has had an existence for several years, in Great Britain, as a most respectable association. Among its members are some of the very greatest men and noblest spirits in that country, and at its meetings lords and dukes mingle together with mechanics and merchants to express their opinions and consult together for the promotion of the general good. The last annual meeting of this association was held in Glasgow; Lord Brougham made the introductory address, and subjects of very great importance to mankind in general were discussed. The effects of machinery upon labor, the effects of different trades upon the health of women and men, and the effects of "trades' unions" and patent laws formed topics for several reports and papers. Such a science and such discussions we hail with pleasure. They are of infinitely more importance than Darwin on the "Origin of Species," "Pre-Adamite Man," or any of those works on natural science which have lately caused so much vehement talk among the scientific dons in both hemispheres. What subject, for example, is of deeper import than the effects of different occupations on the health of operatives? None whatever in a social sense. Well, numerous new facts relating to this question have been collected and arranged, and measures based upon such information have been instituted for the better ventilation of many factories and workshops, and both employers and their workmen have entered upon a career of co-operative effort for the promotion of such social reforms. We can merely allude to these topics, but must not omit that of "trades' unions," or combinations by which strikes have resulted in injury to all classes. This has been a most perplexing element in the social life of the mechanical classes. Statesmen have made laws against trades' unions, and have been glad to repeal them again; because, instead of curing, they only aggravated the evil. Social science now grapples with the subject and endeavors to throw a beam of clear light upon it. At the last meeting of the association referred to a report was presented on this subject, a few words of which we quote as follows:—"The workmen belonging to these societies form a better estimate now than heretofore of the condition of their respective trades; and they have generally overcome the prejudices which they once entertained against machinery, and their leaders are men of high character and intelligence. The improved education of masters and of men is doing more to avert collisions between them than any mere artificial arrangement of a voluntary or forced character."

We are glad to see such questions brought within the domains of science, where they can be examined and discussed in a dispassionate manner. Legislative enactments are merely negative regulations for evils; they seldom operate positively in doing good. We hail social science as a new and superior agency for removing many evils and for promoting the welfare of men.

THE BEST FORM OF STEAM ENGINE FOR MANUFACTURING PURPOSES.

The superiority of steam power over other motors having been fully argued before, we shall not review that subject, but say a few words upon the form of engine, relating to economy and other particulars of the machine, which is best adapted for manufacturers.

The ordinary horizontal engine is the one most generally used, from the simplicity of its construction, its lessened first cost, and from the fact of its being more easily handled by the uninstructed engineer, of whom, for the benefit of capitalists, there are but two many in employment. We shall argue the fitness of the horizontal engine for its purpose over others of different pattern of the same size. In the machine under consideration there is at the outset an objection in the position of the cylinder and its piston, as it increases in size the evil alluded to—that of the weight resting on the bottom of the cylinder—is not lessened but augmented, and with daily use, it is only a question of time when the cylinder shall require reboring. In the matter of packing, which renders the piston steam-tight, there is a word to be said. It is not possible to adjust it so perfectly or evenly as in the case of the engine which we shall mention. We saw only a few days ago a cylinder belonging to a horizontal machine which required reboring. Upon examining it carefully it was found to be scored deeply on the bottom, while the top was very little worn. We deduced from this inspection that the engineer had inserted the springs to the best of his ability, and supposed that he was extending the rings equally throughout the circumference; whereas, the fact was plain that the weight of the piston had been too great for the bottom springs to sustain, and they had set under the pressure with the result mentioned. If we add also the fact that the constant wriggling of the packing (we cannot use a more expressive word) tends to produce a hard gritty powder, and consider the extraneous substances which are deposited with the steam on the bottom, we shall have the secret of scratched cylinders when the greatest care has been used in packing them. These parts and the valves being the heart of the engine, any injury occurring to them results in serious expense. When these engines have their steam chests upon the side, it will be found that the condensed water remaining after stoppage slowly and insidiously eats away the port, in some instances within our knowledge, through to the exhaust passage. It may be argued that the condensed water may be blown out, but more or less of it will remain, and this result is always to be apprehended.

Let us now glance briefly at the other form of engine which, we assert, possesses unusually favorable features, and which should render it universally popular—those with vertical cylinders; and we speak wholly from the plan of the engine, and not from personal bias in favor of one or the other. The points most noteworthy are: an upright cylinder and steam chest, a more even and easily balanced apparatus, and a release of the guides from the superincumbent weight of the crosshead and piston rod, besides a general system of vertical motions throughout. From these specialties there arise important results, which are: a diminution of friction, greater regularity of motion (caused by opposing weights balancing each other), and last, though not least, a preservation of the vital parts of the engine from injury. More especially at this time would we speak of the beam engine as pre-eminently adapted to manufacturing purposes.

On this excellent form of engine there can be no criticism made worthy of special attention. It is true, there are many bearings about them, but in a well built engine the labor is very slight on them, and is more evenly distributed than in the horizontal machine. No more perfect plan can well be devised. In a properly constructed beam engine the weight of the front links, crosshead and piston, with its rod, should just balance the connecting rod and its crank or cranks; and though the equipoise depends of course upon the velocity of the machine, it can be easily adjusted by weights. Centrifugal force increases as the square of the velocity; therefore, what is equally poised at one speed will not be so at another. There are many engines of the class just spoken of in use, and we venture to say, upon our own responsibility, that the proprietors of them would not exchange them for any other plan. Their better qualities are so apparent that there should be more of them in use at the present day—a much smaller bill for repairs and for fuel would be one of the important desiderata achieved.

CLOSER ECONOMY IN STEAM POWER REQUIRED.

With a constantly increasing system of manufactures going on in the country, it becomes necessary to consider what means may be adopted to render the expenses less, and, as a natural consequence, the profits greater. A careful observation in various parts of the States has convinced us that many slight things, or those which appear so, are daily overlooked, resulting in individual loss and delay. It is not in thickly settled neighborhoods that so much waste is observed, but in bye places and obscure streets, where vigilance is relaxed to an alarming degree; in shops where every person runs the engine to suit the work he may happen to have in hand; where the man who tends the engine is indifferent about the supply of feed water, and where the coal is thrown into the boiler in a pile; where the oil is poured into the cups until they run over, and the can carried from one to the other without elevating it. We are not depicting suppositious cases; we have seen that which we write of, and know that such extravagance is daily carried on. What other result may be expected than an unnecessary bill for wasted materials? A simple leak about a washer, or a standing bolt, that loses a jet of steam may seem a small thing to criticise, yet how many such leaks are there not observable in obscure corners that waste steam, which is as certainly money as a bank bill? It may be asked how these things are to be remedied, and we reply, in most cases by the personal supervision of the proprietor; but there is another preventive in which we have great faith, and that is the general integrity and fidelity to their employers' interests of our engineers and mechanics; without whose watchfulness, the inspection, however severe, of the capitalist is of no avail; and we place unbounded reliance on them from a knowledge of and from daily contact with their characters. We ask their attention to these apparently small, but really important matters, confident of the most favorable results.

PHILADELPHIA TURBINE WHEELS.—The Philadelphia *Ledger* says that the new turbine water wheels, now being constructed in that city, for the extension of the water works at Fairmount, will be the largest ever made in this country, each of them being nine feet in diameter, two feet more than the one now in use at Fairmount. It is calculated that the three new wheels will force as much water into the reservoir as the eight breast wheels and the turbine, just doubling the capacity of the works. The size of the new wheels renders the construction of new and large tools necessary. The lathe upon which the casing is to be faced will have to swing a portion of the case, which measures nearly 18 feet in diameter. It is said that no shop out of Philadelphia has the capacity for making these wheels, the cylinders for the Ericsson steamer having been sent from New York to Philadelphia to get bored.

WATERPROOF COATS.—Sometime since a correspondent wrote to us from Mobile, suggesting the importance of making waterproof coats so that they would not be sticky. We have recently examined some coats which are entirely free from this serious objection. They are manufactured in large quantities by Samuel C. Bishop, No. 181 Broadway, this city.

THE POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

[Reported expressly for the Scientific American.]

On account of a general meeting of the Institute occupying Thursday, the usual weekly meeting of the Association was held on Wednesday, 31st ult—Professor C. Mason presiding.

No miscellaneous matter being ready for the meeting, the regular subject, "Caloric Engines," was called up for

DISCUSSION.

The President—As we wish to arrive at the whole truth regarding the utility of caloric engines, we should consider their disadvantages and inconveniences as well as their virtues. I suggest as the most important of the objections urged against them: 1st. The liability of burning out the heaters, thus, in effect, increasing their cost and bringing interruptions in their use; 2d, their small amount of initial force; 3d, the small amount of force relative to the size of the engine. Water in the steam boiler expands to nearly 1,700 times its original bulk, while it is doubtful if air has practically been doubled in volume in any of the air heaters.

Mr. Babcock—Air engines have been a very prolific subject among inventors. In the United States, thirty-five patents pertaining to the caloric engine have been issued, and in England, the number is two hundred; possibly in other countries there are two hundred more. Caloric engines may be arranged into four classes: 1st, Those having a reservoir of heated air, corresponding to the steam boiler. This is a very obvious method of employing air; the class is represented by Paine's engine and by some of Ericsson's inventions. 2d. Such as make use of air mingled with the products of combustion. Of this class are Lord Cayley's, Drake's, and those described by Mr. Seely. 3d. Such as make use constantly of a confined quantity of air, alternately heating and cooling it. Of this class are Stirling's, Hazeltine's, and others. 4th. Such as take in cold air and exhaust it into the atmosphere. To this class belong Ericsson's latest engine, Wilcox's, and others, which are the only engines much in use at the present time.

The President—Why are not engines of the other varieties in use?

Mr. Babcock—I do not know why engines of the first class are not used. The excessive heat and ashes of those of the second class are reasons enough against them. The only engines which have actually been put to use are Stirling's, Ericsson's, and Wilcox's.

The President—How small powers are used?

Mr. Babcock—It would perhaps be easier to say, how large engines are in use? Wheeler & Wilson's sewing machine requires about 1-60th of a horse power. Most, or all of the air engines in use will drive several of these machines. Very few caloric engines have been thoroughly tested to determine their power. Yet it is certain that they work economically as to consumption of fuel.

Mr. Baboock here gave a detailed description of the Wilcox engine, making use of large and cleverly executed drawings. The engine is single acting, and its supply cylinder is of the same size as the working cylinder. The cylinders stand upright and side by side. The pistons are both solid. The supply cylinder has a closely fitting top through which its piston rod passes; the piston of the working cylinder is uncovered. Between the cylinders is a three-way valve which regulates the entrance and exit of the air. Finally, the engine is provided with a regenerator, which Mr. Wilcox prefers to call an economizer. The cold air enters first the space between the cover and piston of the supply cylinder, entering by the pressure of the atmosphere on the descent of the piston. When the supply piston rises, this cold air is forced through the regenerator down to the bottoms of both cylinders, which are in contact with the fire. The air thus heated expands and drives upwards the working piston. While the supply cylinder is receiving cold air, the working cylinder is exhausting through the regenerator; the pistons of course have an unequal motion.

Mr. Churchill.—Is there any novelty with respect to lubrication?

Mr. Babcock—Yes; the working cylinder has a top perforated with a line of holes, so as to direct the incoming air, as the piston descends, against the inner surface of the cylinder. The supply cylinder is always cool. Above the metallic packing, there is a ring of cotton always saturated with oil; the oil is supplied twice a day. The economizer, in capacity ½ of the cylinder, prevents the valve from overheating. There is now no difficulty with the lubrication. Wilcox's engines have run at the rate of 2½ pounds of coal per horse power per hour. These engines work very smoothly, and with little noise. The working temperature is supposed to be 600° Fah.

Mr. Stetson—Give the temperature of the exhaust.

Mr. Babcock—It is about 300°. The balance of the 600° is taken up by the economizer.

The President—Was the name "regenerator" dropped on account of its sectarian sound? [Laughter.]

Mr. Roosevelt—Perhaps Stirling was a Calvinist minister. [Laughter.]

Mr. Babcock—Mr. Wilcox simply considers the word "economizer" more expressive of its use. The word does not imply any theory, but indicates a fact.

Mr. Seely—At the last meeting I gave some details of methods of using the products of combustion, and also proposing to cool the air which might be overheated by causing it to pass in contact with water. When I commenced calculations and experiments in this direction, it was with the supposition that none of the practical expansion would be lost. I assumed, for example, that if a cubic foot of air at a pressure of 50 lbs., and at a temperatute of 2,000°, be brought in contact with boiling water, the temperature would be at once reduced to less than 300°, and the tension of 50 lbs. would be maintained; that although the air would be lessened in bulk, sufficient steam would be formed to exactly compensate such loss. This proposition was submitted to various scientific friends, and was fully endorsed. But a little consideration of the laws of specific heat shows clearly that it is not rigidly true. The specific heat of water being 1, the specific heat of air is .25, or, in other words, the same amount of heat will have four times the effect on air as on water. A quantity of heat which will raise 1 lb. of water 10°, will raise 1 lb. of air 40°, and if air at a high temperature be mixed with water at a low temperature, the air will lose in temperature 4°, when it raises the water only 1°. If there was a doubt of the universality of this relation of air and heat, it would be in the case where water is converted into steam. But a very simple calculation shows that in this case also the same relation exists. I use round numbers, which are near enough to the truth for my purpose. One pound of water at 212° occupies 27 cubic inches. By the addition of 1,000 units of heat, these 27 cubic inches of water will become 27 cubic feet of steam; 27 cubic feet may therefore be taken as the measure of the expansion of water by 1,000 units of heat. Now what is the case with air? One pound of air occupies 13 cubic feet; 1,000 units of heat will raise the temperature to 4,000°, and as the original volume of air is doubled for each 500°, the resulting volume will be $8 \times 13 = 104$; 104 cubic feet, therefore, is the measure of the expansion in air of 1,000 units of heat, and as 104 is 4 times 27, the relation of water and air to heat, in the case supposed, is found to be no exception to the general rule. Although this calculation very much weakens the plan of using water and air together, it is by no means fatal, as I am prepared to show. But it is plain that the products of combustion may be used at as high a temperature as air alone, and when the hydrocarbons are used there can be no difficulty of ashes. There is another special reason why hydrocarbons will prove useful. The hydrogen which they contain combines with oxygen and forms steam, which carries the heat into the latent state, and thus will give a higher pressure than the same weight of air alone, at the same temperature. When coal burns, carbonic acid is formed, which occupies, when cooled, the same space as did the air and coal before combination, and the expansion due to the heat is precisely the same as would be given to air by the same heat. But with the hydrocarbons the case is quite different, for the steam formed occupies a far greater space than did the hydrogen and oxygen before the union; the hydrogen in the hydrocarbon is in a condensed form. The composition of the coal oils and other hydrocarbons plainly show the value of these considerations. The lightest of the coal oils is benzole ($C_{12}H_6$), and the illuminating and heavier oils have a gradually increasing proportion of hydrogen. Add C_2H_2 to the formula of a coal oil, and you will have the formula of the next one heavier in order. Thus toluol is $C_{14}H_8$, and cumenol, $C_{18}H_{12}$; in benzole, carbon is to hydrogen as 2 to 1, but in cumenol, as 3 to 2. The composition of alcohol is $C_4H^6O_2$, and in alcohol the carbon in effect is combined with the oxygen and hydrogen, so that it it may be viewed as condensed matter which expands on burning, taking much of the heat into the latent state. From the fact that alcohol gives no light, I think it certain that the carbon is not separated as an element on burning. Moreover, alcohol with 20 per cent, or more, of water, readily burns, giving up the heat of combustion to the conversion of this water into steam. I have seen it stated that the coke produced from a tun of bituminous coal was as effective in producing steam as a tun of the original coal. The products of combustion go away from hydrogen or a hydrocarbon comparatively cool.

Mr. Stetson addressed the meeting at considerable length on the peculiar uses and advantages of the caloric engine. His endorsement of air engines appeared to meet the general approval of the society.

Mr. Dibben doubted the statements of the economy of fuel in the caloric engine. Yet, from the fact that a dozen or two of Wilcox's and 500 or 600 of Ericsson's engines are in use and satisfy their owners, it is evident that they have genuine merit.

Mr. Roosevelt—Fifty thousand dollars spent on bread pills will bring a fortune, and the pills will cure and give satisfaction. I have never seen a caloric engine which could'nt be stopped in grinding an ax.

The President—One large boiler may drive many steam engines.

An engineer—When the steam engine is not in use, the steam may be employed for warming and other purposes.

Mr. Stetson—At present there seems to be a necessity for making the caloric engine single-acting. Ericsson's engines are very much over-rated in their power. I have tested one carefully by the friction brake. It was an 18-inch engine employed in driving printing presses at Dodge & Grattan's, in this city. It was rated by some at 4 horse power. I found that when diligently fired, it performed with exactly two-thirds of one horse power. But the extravagance of some estimates should not lead us to underrate its actual performance. The caloric engine, both of Ericsson and Wilcox, is a success. It is difficult to compare strictly with steam engines. The performance of an engine depends much upon its construction; so that a steam engine of two horse power may do the work of only one man, or of six or eight horses. The expense and trouble of replacing the heaters are very small. The Ericsson heaters are much more exposed than the Wilcox heaters, but even in the Ericsson engine, the most exposed parts endure a year or more with moderately hard firing, and are replaced at an expense of only $15. The great economy of the caloric engine, however, arises from the case with which it may be kept in operation without a professional engineer.

Mr. Fisher—There is no doubt of the superior durability of the steam engine. Boilers well made and properly used will last fifty years. Watt, for safety, used steam at 5 or 10 lbs. We can make boilers which are perfectly safe for steam at 60 lbs. If the caloric engine should take the place of all the steam engines now in use, we should probably discover chances of accident and danger of which we now know nothing.

Lieut. Bartlett—There should be no contest between steam and air engines. Each has its place, and each is admirable. The caloric engine is only proposed for circumstances where steam is impracticable. There is a wide enough field for both; both deserve our praises. [Applause.]

Subject for next week: "Preservation of Timber Exposed to the Weather."

After the adjournment, a large number of the audience passed to another part of the building and examined a Wilcox engine in operation. Mr. Roosevelt, who had proclaimed himself a doubter of the power of caloric engines, was called upon to stop the engine. This feat he at once accomplished by pressing his hands on the fly wheel. The engine however performed hand

somely, and seemed to be generally approved. The experiment of closing the ports was tried, and the engine kept in motion till all were satisfied and tired.

ENLARGED FIELDS FOR INVENTION.

Now, that the excitement of the presidential election is over, we presume the several industrial operations of the country will resume their usual steady character, less subject to interruptions than they have been for some months past; and, in harmony with this resumption of work, we look for renewed activity among the hosts of inventors. This most valuable class of the community is steadily becoming larger, from the constantly widening field for improvement. Railroad traveling, telegraphing, machine sewing, every new art that is introduced opens a broad field for the exercise of inventive genius. Again, as wealth and population increase, and labor becomes more subdivided, small improvements in the details of mechanism become of greater value, and they are consequently invented and patented in constantly increasing numbers. Thus we have a large number of patents for coupling belts, for stepping millstone spindles, for journal boxes, for shafting hangers, and for other small improvements in the arrangement of machinery.

But the most powerful agency in enlarging the field for invention is the increasing knowledge of the properties of matter. Every new substance that is discovered opens up the possibility of an indefinite series of combinations with other substances already known. For instance, who can foretell the number of inventions which will result from the discovery of aluminum? In the first place is the problem of reducing it from the clay of which it forms a part—one of the most inviting of all the fields which are now open for the exploration of the man of science. Every bank of clay is the ore of a precious metal, and the man who discovers the most economical process of separating the metal from the ore is sure of a very large reward. Then, the introduction of this new metal, with its peculiar properties, into the arts, renders possible a vast variety of new and improved combinations of mechanism by its means. Still farther the new machines will probably require modified tools for their construction; and thus the consequences of the introduction of this one substance into the arts are ramified in so many ways that the mind is bewildered in the effort to follow them.

If we enter the laboratories of the chemists, we find that there are innumerable substances, possessed of almost every conceivable property, which now merely serve for the idle amusement of abstract students, but which are doubtless destined to be appropriated by practical men to useful purposes, and made to contribute their share to human comfort.

People, in looking about and seeing every department of art full of patent inventions, are apt to imagine that the field is all explored and the work all done; but as Newton, after all his studies, declared himself but as a child wandering on the sea shore and picking up a few grains of knowledge, while the great ocean of truth lay unexplored before him, so is it with the mechanic arts; even now they are but in their infancy. As long as human knowledge is limited, as long as man is imperfect, so long will the opportunities for improvement remain unexhausted.

NEW STEAM FIRE-ENGINE.

On the 6th inst., a new steam fire-engine, built by the Amoskeag Manufacturing Company, of Manchester, N. H., was tested in this city. Its boiler is a vertical tubular, having 243 1-inch tubes with 155 feet of heating surface. Its steam cylinder is 12 by 8 inches, placed vertically near the top of the boiler. The pump is 4¾ inches in diameter, situated directly under the steam cylinder. The piston rod of the engine is connected to a yoke placed midway between the stroke of the two cylinders, and this is connected to two cranks which rotate a shaft having a small balance wheel at each side of the engine. The piston rod of the pump and that of the steam cylinder being connected to the yoke, they almost directly reciprocate; the arrangement is simple, so as to connect the reciprocating motion of the piston, with the rotary motion of the balance wheel shaft, to equalize the action and overcome the dead points. The feed pump is a common locomotive one, worked from the yoke described. It is quite a light engine, intended to be drawn to fires by hand, and its mountings are quite elaborate. It was tried at the famous test pole in West Broadway, and we paid particular attention to the time required to raise the steam to the working point—a most important consideration in all such engines. From the instant the fire was lighted with wood until the machine was working with steam at 20 lbs. pressure, the time was 5½ minutes; in 10 minutes, it was up to 40 lbs., and in 15½ minutes, it was 100 lbs. on the inch. The day was very windy and unfavorable for playing high, but it occasionally sent a stream 160 feet up the pole, out of a 1¼ inch nozzle. The pole is 187 feet to the very top, and we think that it would have played to this hight had the day been more propitious. There appeared to be no difficulty experienced in working steadily and keeping up a steam pressure of 100 lbs., with cannel coal. Sometimes the pump made no less than 280 strokes per minute; on the whole, the working of this engine produced a favorable impression on the mechanics present. All the steam fire-engines which we have lately seen have vertical boilers; these are more favorable for raising steam, but a locomotive horizontal boiler would afford a superior arrangement for the framing, and would be more solid for running over rough streets; there is still room for several improvements in steam fire engines.

A fire broke out in the rear part of the Astor House, on the morning of the 8th inst., but did not do much damage, as two steam engines of the Lee & Larned class were soon on hand and performed admirably. One large hand engine (No. 14) was also in operation, but, though a first-class engine, it appeared very inefficient beside the conquering power of steam. The firemen manned the brakes, and, in their red shirts, tugged and sweat like heroes, but they could not compete with iron muscles and lungs of steel.

On the subsequent morning (9th), a fire broke out in the large drug store of Penfield, Parker & Mower, in Beekman-street, at which the above Amoskeag engine (*Champion*, by name) was brought out and did admirable volunteer duty, along with two of Lee & Larned's engines.

Typographical Error.—Perhaps some of our readers have noticed a paragraph that recently went the rounds of the press, which originated in a typographical error in the *Springfield Republican*. Two accounts got mixed up together, one of a runaway dog, and the other of the inauguration of a minister, which resulted in the publication of the statement that the respectable clergyman was last seen running down the street with a tin kettle tied to his tail! We have had our share of annoyance from these typographical errors, but we believe the most annoying one that we ever endured occurred in last week's issue, in Mr. Charles Seely's report on water gas. Two queries were asked which got transposed, and to make sense our readers will please understand that the former should be, "What is the effect when you shut off the *steam?*" and the latter, "What is the effect when you shut off the rosin?"

Hearing in large churches can be made comparatively easy by an arrangement of a sound reflector which has recently been applied in Trinity Church, this city. It consists of a paraboloidal reflector of sound placed at the back of the pulpit, of which the speaker's mouth is the focus. A beam of sound, about ten feet in diameter, is thus thrown to the most remote point of the church, and, by its side flow fills the whole body of the building.

All irons of commerce which have been examined contain sulphur; they also deposit silica and black matters when treated with diluted acids, and, consequently, are impure. Iron can be prepared in a pure state only by pharmaceutists, its preparation requiring the minutest care; industry can furnish iron only of a relative, not absolute, purity. It appears that chemically pure iron may be kept an indefinite time in distilled water without exhibiting the least trace of oxydation, and retaining all its metallic luster.

Pike's Peak Gold.—The average fineness of this gold is .832, valued at $17 20 per ounce. The loss in melting, cleaning and refining varies from four to twelve per cent, according to the specimens.

RECENT AMERICAN INVENTIONS.

The following inventions are among the most useful improvements lately patented:—

CAPSTAN WINDLASSES.

This invention consists in combining the capstan with the barrel of the windlass by means of a worm wheel on the barrel of the windless and an endless screw on a central shaft, which is so fitted to and combined with the capstan, and so furnished with the pawl rim and stops, that the capstan may either be employed to work the windlass—in which operation it gives a very powerful purchase—or may be employed independently of the windlass in those operations in which capstans are commonly used on board ships. The patentee of this invention is Samuel P. Patten, of New York City.

CLOTHES' SPRINKLER.

This invention is a useful device for sprinkling or wetting clothes previously to ironing them. It consists in combining with a cylindrical bellows, small enough to be conveniently used with one hand, a siphon-shaped tube, and a small barrel with a hole in one end, which hole is stopped by a simple valve when a pressure is put upon the bellows, the end of which barrel is finely perforated around the central hole, for allowing the water to issue from the barrel in fine jets or sprays. The credit of this contrivance is due to Sarah N. Davies, of Muskegon, Mich.

A Fan for an Empress.—During the recent visit of the emperor and empress of France to Algeria, a number of jewish ladies presented her majesty with a notable fan. This article is principally formed of white ostrich feathers fixed in a golden disk ornamented around the edge with pearls, rubies and emeralds, and in the center with arabesques in enamels on gold, of different colors, and with rubies, emeralds and diamonds. In the center is a Hebrew inscription mentioning the conquest of 1830—a date not agreeable to the Moors, since it was that at which their domination in Algeria ceased. The handle is in coral, fluted with gold and ornamented with fine pearls. The upper part is divided into two branches, ornamented with arabesques, and having the imperial crown in gold; the other end terminates in a golden ball studded with stars in diamonds, and bearing a ring ornamented with rubies and emeralds. On one side of the handle is a large emerald surrounded with a double triangle, forming a star with six points, ornamented with arabesques, rubies and brilliants.

It seems that the early French settlers and the Indians in Western Pennsylvania were acquainted with the natural oil or petroleum wells, which are now thought by many persons to be a new discovery. At Franklin, Pa., old oil vats have been discovered, with trees a century old growing in them. An old well, supposed to have been sunk for obtaining the oil, has also been discovered, with the remains of an Indian ladder in it. The early settlers used to place a dam on the creek, then take off the oil which floated on the surface by absorption with blankets. This they used to sell in vials as a medicine for curing rheumatism.

Mr. Merriam on the Late Earthquake.—The following are Mr. Merriam's remarks on the shock of earthquake which was lately felt in the North and East. He says:—"A time cycle of twelve years has run its round since October 17, 1848, when the Islands of New Zealand, at the antipodes, were visited by a company of terrific earthquakes, numbering more than a thousand strong, which vibrated through the earth's body, and were felt on the sea coast of England. Then the aurora australis and the aurora borealis united their labors, and a bright band encircled the whole earth."

Foreign Iron.—A correspondent of the St. Louis *Evening News* directs the attention of the citizens to the very bad quality of foreign iron which has been imported for the railroads of the Great West. He asserts that it is mere *rubbish*, and that far superior rails can be manufactured in St. Louis for $60 per ton.

Deafening Floors.—A correspondent (L. A. D., of Dupre, La.) informs us that he has found dry sawdust a most convenient and excellent material for filling in between partitions in rooms and floors for the purpose of "deafening sound."

AMERICAN ENGINEERS' ASSOCIATION.

[Reported expressly for the Scientific American.]

On Wednesday evening, Nov. 6th, the usual monthly meeting of this association was held at its room, No. 24 Cooper Institute, this city—Thomas B. Stillman, President, in the chair; Benjamin Garvey, Secretary.

The customary miscellaneous business having been transacted, the election of members was proceeded with: the names published in this journal, as those proposed at the last meeting, were taken up. A member present objecting to the name of one person upon that list, as being unfit to become a member of this society, it was resolved that each be singly ballotted for. This was done, and all, with one exception, were unanimously elected. The subjoined were proposed for the same object:—Robert Simpson and Abraham B. Davies.

Mr. Louis Koch, in behalf of the Committee on Science and New Inventions, gave the society, by request, a verbal report of their decisions in relation to the articles lately submitted to them. As this report was referred back for the purpose of having it properly presented in writing at a subsequent meeting, it will be better to defer its publication until that period.

The Board of Managers have in progress the revision of the constitution, by-laws, &c., but not being in such a state of forwardness as to admit of report at this time, it was resolved, in order to facilitate the accomplishment of this essential business, that, when the association adjourns, it do so till Wednesday evening next, that the above work might be acted upon, and finished, if possible.

At this period the society were pleased to inspect and listen to an explanation of the annexed

NEW INVENTION.

Oscillating Piston Engine.—Mr. Mark Runkel exhibited his new oscillating piston engine. This engine consists of a short cylinder, the central portion of which is occupied by a wheel performing the office of a piston, which makes about half a revolution in one direction, and then stops and turns back in the other direction—thus oscillating back and forth. The wheel is made with two wings fastened securely upon it, extending to the inner surface of the cylinder, and packed steam tight on their sides and ends. Two abutments are secured rigidly to the cylinder, and project inward to the wheel or piston, being packed at their ends so that the piston may revolve against them steam tight. Steam is admitted and discharged through ports which communicate with an ordinary steam chest, and are opened and closed by the common D-valve, or any valve of suitable form. The crank or arm on the end of the axle is made of a proper length in relation to the length of the crank on the flywheel shaft, to cause a revolution of the latter at each oscillation of the former. The pressure on the axle of the piston is balanced as it acts on both sides, thus reducing the friction to a low point and obviating all tendency of the piston to get out of place by wearing its bearings. The inventor, among other points, claims simplicity, durability, compactness and economy of space and great effective power. This engine dispenses with slides, and renders high-pressure velocities of piston practicable of attainment.

This invention was referred to the appropriate committee, who will duly report thereon.

After a few unimportant remarks on other subjects, the meeting adjourned.

A NOVEL YACHT.

The London *Illustrated Times* contains the engraving of a beautiful yacht in the form of a white swan. Its length is 17 feet 6 inches, its greatest breadth of beam 7 feet 6 inches, and its hight from the keel to the top of the back, 7 feet 3 inches. Even in detail the proportions of a swan on a large scale are strictly adhered to. Its neck and head, beautifully carved, rise gracefully 16 feet above the water line. The wings of the bird are represented by the sails. The vessel is a perfect life-boat. Beside the wings, a propelling force is given by means of two powerful steel-webbed and feathering feet, placed in their natural position between the keels. The seats are covered with green morocco, and stuffed with granulated cork and cocoa-nut fiber. The ceiling is lined with a 3-inch air casing to exclude the heat. There are Venetian blinds at the sides, with oval plate glass windows, which can be lifted or lowered at pleasure. In the center is a table, and there are small apertures which open to the water underneath, and thus afford the opportunity of fishing while sitting at table. Any aquatic prey thus obtained may be dressed in a multum in parvo cooking apparatus on board, the smoke from which is conveyed through the bird's neck and out at its nostrils, the woodwork being protected by a safe water casing round the flue. In the breast of the bird is a ladies' cabin, fitted up as a boudoir. The fittings also include a pumping apparatus, a fresh water tank, and lockers innumerable for the storing of every necessary. The whole interior is either covered with morocco or delicately painted. The steerer sits high in the tail of the bird, and, with halyards in hand, controls the vessel as easily as the driver does his horse. Behind the neck is an aperture large enough for a man to get out of when the sails require reefing or the anchor lowering. The Swan's register is about five tuns, its internal capacity 500 cubic feet. When fully stored, and carrying 15 persons, its draft of water is only 17 inches.

Poison in Finger Rings.—All visitors to Paris will have noticed the shops of *bric-à-brac*, or objects of curiosity and *vertu*, so numerous and tempting in that capital. At one of these establishments, in the Rue St. Honore, a gentleman was engaged a short time ago in examining an ancient ring for sale there, when he accidentally gave himself a slight scratch in the hand with a sharp point of it. He continued talking with the dealer for a short time, when he felt an indescribable numbness and torpor taking possession of him, and paralyzing all his faculties, and soon became so ill that the people in the shop hastened to call in a physician. The doctor immediately declared that the gentleman had been poisoned by some powerful mineral substance, applied strong antidotes, and was fortunate enough to relieve the symptoms which had caused so much alarm. The ring was then examined by the medical man, who had spent some time in Venice, and who found that this old jewel was what is there called a "death ring," a class of ornaments in frequent use in Italy during the seventeenth century, when the habit of poisoning was all but universal. Attached to the part of the ring intended to be worn inside the finger are two minute lion's claws, of the sharpest steel, and having clefts in them filled with a violent poison. In a ball or other crowded assembly, the wearer of this fatal ring, wishing to exercise revenge on any one present, would take the victim's hand, and when pressing it ever so gently the sharp claw would be sure to inflict a slight scratch on the skin, and the victim would be equally sure to be dead before the next morning. Notwithstanding the length of time which must have elapsed since the poison was secreted in the ring in question, it was still powerful enough to cause great danger, as has been seen, to the gentleman who had so unwarily touched it.

Amusing Explosion of a Barrel.—The following funny incident occured on the 30th ult. at the railroad engine house at Springfield. Mass. One of the engineers, not having the fear of the constable before his eyes, had wickedly purloined an oil barrel which he designed to fill with cider; but how to remove the smell and taste of the oil, to fit it for such a purpose, rather puzzled him. In this momentous emergency he took counsel from a friend, who mischieviously advised him to fill it nearly full with unslacked lime and water. This was done, when lo!, the barrel was soon at high pressure and exploded, throwing the engineer some distance into the air, and landing him astride of an engine smoke stack with a hoop in each hand. No further harm resulted.

The Philadelphia papers employ glowing terms in describing a new steam fire engine built for that city by the Portland (Maine) Locomotive Company. It weighs only 3,100 lbs., has a steam cylinder of 8-inch bore and 9-inch stroke.

Ancient Churning Process.—The mode of churning in Fayal, one of the Azores, is to tie the cream up in a goat skin, and kick it about till the butter comes.

ISSUED FROM THE UNITED STATES PATENT OFFICE
FOR THE WEEK ENDING NOVEMBER 6, 1860.

[Reported Officially for the Scientific American.]

. Pamphlets giving full particulars of the mode of applying for patents, size of model required, and much other information useful to inventors, may be had gratis by addressing MUNN & CO., Publishers of the Scientific American, New York.

30,555.—F. C. Adams and Joseph Peckover, of Cincinnati, Ohio, for an Improved Hinge:

We claim forming a hinge by the combined use of the large cut under recess on one part, and the projection b c d, or its equivalent, on the other part, and the molten zinc, or other easily fuzed metal, run in between them, substantially as and for the purpose set forth.

30,556.—C. E. Atherton, of Paterson, N. J., for an Improvement in Vapor Lamps:

I claim the combination and arrangement of the gas receiver, the self-acting valve or gage at the top of the generating tube, with the use of the metal rod and beveled pin, substantially as and for the purpose set forth.

30,557.—M. H. Bacon, of Mystic, Conn., for an Improvement in Machines for Dressing Stone:

I claim, first, The arrangement of the vibrating frame, G, with the lever, M, and the spring, K, for increasing the force of the blows at pleasure beyond that due to gravity alone.

Second, The employment of the checking spring, J, in combination with the vibrating frame, G, and lever, M, or their equivalents substantially as described, for diminishing the force of the blows at pleasure below that due to gravity.

Third, The arrangement of the recess, r, in the vibrating frame, G, the stop, R, on the sliding frame, C, and of the gearing, H and O, substantially as and for the purpose set forth.

Fourth, The employment of the sleeves, T, operated by the screws U, or their equivalents, for adjusting the hight of the cutters, S, in the cutter frame, F, in combination with the means for adjusting the inclination of the several cutters, S, in their respective sleeves, T, substantially as set forth.

30,558.—Wm. B. Barnes, of Forestville, Conn., for an Improvement in Clocks:

I claim the arrangement of the verge, g, detent, k, triangular shaped escape wheel tooth, e, in combination with a pendulum, n, substantially as and for the purpose described.

I claim, in combination with the arrangement above described, the arrangement of the pointer spindles and gearing attached thereto, substantially as and for the purpose described.

30,559.—John Beaumont, of Hartford, Conn., for an Improvement in Coffee-pots:

I claim the arrangemeet, in the manner and for the purpose specified, of the coffee-pot, a, provided with the liquid joint, f, the receptacle, b, having the perforated bottom, c, and perforated cover, e, and the condenser, d, provided with the cavity, i.

30,560.—N. Britton, of Lockport, N. Y., for an Improvement in Lightning Rods:

I claim the construction of lightning conductors with parallel continuous strips or tubes of metal held at a distance apart and united by intervening washers or blocks, substantially in the manner and for the purposes specified.

30,651.—M. A Butler, of Mariana, Florida, for an Improvement in Compositions for Soap:

I claim the described soap composed of the ingredients specified, and mixed together in about the proportion described, for the purposes set forth.

[The object of this invention is to produce a cheap soap which can be used in water containing mineral or metallic substances equally well as in ordinary soft or pure water.]

30,562.—C. F. Chambers, of Chambersburg, Ind., for an Improved Washing Machine:

I claim the combination of upper rubber, D, adapted to reciprocate on stationary ways, C, and the swinging lower rubber or board, F, adapted to be elevated from the tub, and to hold the clothes stationary for the upper rubber to act upon, or to be depressed at will, as and for the objects set forth.

30,563.—A. B. Colton, of Athens, Ga., for an Improved Spike for Threshing Machines:

I claim the combination of reversible spike, A A a, flanged and shouldered plates or rings, C a g h d, and screw bolts B, substantially in the manner and for the purposes described.

30,564.—James Davies, of Schuylkill Haven, Pa., for an Improvement in Canal and River Locks:

I claim, in combination with a lock chamber, a passage or passages through which the water may flow back in to the upper level, when a boat enters the lock from above, and through which water may flow into the chamber from the level below when the boat is leaving the lock, substantially in the manner and for the purpose set forth.

30,565.—S. N. Davies, of Muskegon, Mich, for an Improved Clothes' Sprinkler:

I claim the combination with a suitable bellows of the syphon tube, C, and the barrel, G, with its perforated end orifice, b, and valve, H, arranged and operating as and for the purposes set forth.

30,566.—John Davis, of Elmira, N. Y., for an Improvement in Apparatus for Detaching Horses from Carriages:

I claim the arrangement of the whiffle-tree as constructed with the thills provided with the hooks, H H, and springs, I I, substantially as and for the purpose specified,

30,567.—A. K. Eaton, of New York City, for an Improved Gold Amalgamator:

I claim, first, The use of an inferior amalgamated surface, substantially as specified, in contact with the superior surface of a body of mercury.

Second, I claim the combination of the rotary disk, with the hollow shaft and receiving bowl, substantially as described.

30,568.—M. W. Dillingham, of Charlestown, Mass. for an provement in Vapor Lamps:

I claim the application of the valve, O, and cup, E, to the wick tube, in such manner as to enable both valve and cup to turn together on the wick tube, and with respect to the lateral discharging orifice thereof, as described.

Also, The arrangement and combination of the cup or thimble, E,

the gas heater, C, the wick tube, A, and its burner, the whole being as specified.
Also, The arrangement of the conduits or passages leading from the wick tube through the cap, B, the heater, C, and into the burner D, as described.
Also, The arrangement of the jet holes, f f, of the slit, e, of the burner, viz., at the termini of such slit, as and for the purpose described.

30,569.—Moses Depuy, of Pittsburg, Pa., for an Improvement in Making Hoes:

I claim the combining and fastening of a steel or iron blade and a malleable wrought or cast iron tang, A, by means of the groove or furrow, b, and the flanges, c and e, and the rivet, k, substantially in the manner set forth and described.

30,570.—Sylvender Ellis, of New Britain, Conn,, for an Improvement in Washing Machines:

I claim the combination of the conical cylinder, c, with the revolving plate, d, arranged within a tub, a, having the adjustable features described, arranged and operating together for the purpose specified.

30,571.—Jacob Frick, of Philadelphia, Pa., for an Improved Shutter Fastener:

I claim the bar, F, and the spring, d, with its projection, e, in combination with the plates, C and D, the latter having the recesses, h and f, and the projections, i and j, or their equivalents, and the whole being arranged and applied to the shutters as and for the purpose set forth.

30,572.—Franklin Getz, of Amherst, N. Y., for an Improvement in Drivers' Seats for Mowing and Reaping Machines:

I claim, first, Suspending the seat board, E, from the spring, F, by means of the swivel strap, G, and rod, G', the seat board having a free movement upon the bolt, j', so as to allow of a lateral swinging movement of the seat board, for the purpose and substantially as described.
Second, I claim the post, M, in combination with the "Kirby machine," for the purpose of supporting the rear end of the seat board in order to locate the driver's seat in front for reaping, substantially as described.

30,573.—A. J. Hardin, of Shelby, N. C., for an Improvement in Machines for Cleaning Cotton Seed:

I claim, first, The arrangement of the cylinder, E, provided with arms or pins, d d, with the cylinder, C, composed of a series of square bars, c c c, placed in the position represented, and with the external gauze casing, D, the same being used and operating in the manner and for the purpose specified.
Second, In combination with the subject of the first claim, I claim the inclined plane, J, spout, I, and revolving screen, I, when used as and for the purpose specified.

30,574.—G. C. Hinman, of Portageville, N. Y., for an Improvement in the Seats of Water Closets:

I claim the combination of the cord, C, pulley, D, and weight, E, with the seat, B, for the purpose of making the seat, B, self-elevating, substantially as described.

30,575.—J. M. Hunter, of New York City, for an Improvement in Apparatuses for Trying Oils:

I claim, first, The described arrangement and combination of the press and boiler, the former being placed within the latter, for the purpose of rendering oils or other fatty matters by thoroughly pressing the scraps while the same are exposed to the boiler heat or steam heat, substantially in the manner and for the purposes described.
Second, I claim the use of the crib for preventing the scraps from coming in contact with the boiler, substantially in the manner described.
Third, I claim the employment of the pressure heads and right and left hand screws, by means of which the oil may be separated from the scraps, substantially in the manner described.

30,576.—Warren Iddings, of Warren, Ohio, for an Improvement in Embalming Dead Bodies:

I claim the described process or mode of embalming the same, consisting of the three steps combined, the different compositions of matter being employed substantially in the manner and for the purposes set forth.

30,577.—J. L. Jones, of St. Louis, Mo., for an Improvement in Truss Bridges:

I claim, first, The flexile curved splice in the lower chord, when said splice is formed of broad flat plates, c c' b' b'', with lateral curved offsets or lugs, c''' b''', formed on their ends, said offsets pulling against one another and allowing a free independent movement of each plate in the path of a vertical circle, substantially as set forth.
Second, The combination of the convex or arched surface of blocks, d k s d' c' x', with similarly convex or concave flanges, t, at the ends of the tubular braces, o and z, substantially as and for the purposes set forth.
Third, The metallic clamps or recessed blocks, d e d' c', for retaining and holding together the tension joints of the upper and lower chords or stringers, in the manner and for the purposes set forth.
Fourth, The grooved shoe, W, which connects and ties the lower chords and floor beams together, substantially as and for the purposes set forth.
Fifth, The septum or longitudinal partition, 2, and transverse tubes, p, combined within the bore of the tubular brace, o, in the manner and for the purposes set forth.
Sixth, The shoe, j, as constructed and combined with the lower end of the tubular diagonal brace and the extreme end, a a, of the lower chords, substantially as and for the purposes set forth.

30,578.—Henry Johnson, of Washington, D. C., for an Improvement in Vapor Burners:

I claim so placing the reservoir or fountain in relation to the burner that the lowest point of the fluid shall be at or about the level of the burner, and the highest point below the level of the top of the generator or gas pipes, b c, in the manner and for the purposes set forth.
I claim covering the upper ends of the gas pipes, b and c, by the screw cap, n', constructed as set forth, so as to embrace the open ends of these pipes in one open common cavity in the cap and screw over them, in the manner set forth.
I claim the elevated conductor, n n', rising above the highest level of the fluid in the fountain, as set forth.

30,579.—Wm. Kearney, of Union, N. J., for an Improvement in Wrenches:

I claim the jointed jaw, C D, with its rule joint foot, when combined with the spring, E, and the inclined plane, f, and constructed substantially in the manner and for the purpose set forth.

30,580.—Wm. S. Kirkham, of Brantford, Conn., for an Improvement in Locks:

I claim the arrangement of the sliding yoke, F, lever, G, spring, H, and slide or latch, C, essentially as and for the purpose set forth.

[The object of this invention is to obtain an equal action of the knob hub upon the slide of a lock when the knob is turned in either direction; that is to say, having the parts which connect the knob with the slide or latch so arranged that the slide will be actuated or drawn back within the lock case with the same facility and application as when the knob is turned in either direction.]

30,581.—Wm. S. Kirkham, of Brantford, Conn., for an Improved Blind Fastener:

I claim the tube or socket, B, having the bar, D, and spring, f, secured within it and provided with the tapped flanches, c c, in connection with the plate, C, provided with lugs or projections, e, and screws, d, all being arranged essentially as and for the purpose set forth.

[This invention relates to an improvement in the ordinary shutter and blind catches or fastenings which are employed for securing shutters and blinds in both an open and closed state. The object of the invention is to facilitate the application of the fastening to the shutter or blind, provision being made for its adaptation to the varying thicknesses of shutters and blinds, as also to insure a firm and durable connection of the fastening thereto.]

30,582.—John Lewis, of Elizabeth, N. J., for an Improvement in Attaching Sails to Ships' Yards:

I claim, first, The clamps, c c, fitted and acting substantially as set forth, to retain the sail to the yard or spar, or allow of its being disconnected, as specified.
Second, I claim the ear ring formed of the chain, f, fork, h, and screw, m, to firmly clamp or grasp the yard or spar, regardless of the size, as set forth.
Third, I claim the hasp, f f', in combination with the ear ring, in the manner and for the purposes specified,

30,583.—Levi Loring, of Saco, Maine, for an Improved Milking Stool:

I claim the application to a milking stool of the platform or stand provided with a spring for fastening when closed, constructed as described and for the purpose specified.

30,584.—Wm. H. Livingston, of New York City, for an Improved Device for Sustaining Trees:

I claim the segmental tree supporter, b, constructed and operating substantially as specified.
I also claim the hook, e, formed with the loop, 3, by which said hook and the wire or brace connected thereto may be lifted on to or off a limb or branch, for the purposes and as set forth.

30,585.—W. W. Paddock, of Cincinnati, Ohio, for an Improvement in Sealing Preserve Cans:

I claim the combination of the automatic valve, C, exhaust chamber, D, and permanent sealing cup, E, constructed and aaranged to operate substantially as and for the purposes set forth.

30,586.—J. E. Parker, of West Meriden, Conn., for an Improved Door Lock:

I claim the described mode of constructing a reversible door lock—that is to say, by so making the head of the latch bolt in a separate piece and connecting it with the follower, that the said head may be taken out and reversed at pleasure without disturbing any of the other parts, substantially as set forth.

30,587.—Henry Pennie, of Buffalo, N. Y., for an Improved Stop Hinge:

I claim the combination of the compound hinge, J, with an ordinary hinge, D, both being arranged and operating substantially in the manner and for the purpose set forth.

[The nature of this invention consists in the combination of a compound hinge for carriage and other doors, with an ordinary hinge; thereby constituting a stop hinge, which prevents the door from being opened beyond a certain angle.]

30,588.—J. M. Pitts, of Sumter, S. C., for an Improvement in Apparatuses for Fractured Limbs:

I claim one or two pairs of staples secured to the bed frames—one pair at the sides of the mattress and the other pair at the sides of the head pillow—in combination with straps and a shoe or gaiter, or its equivalent, fastened to an adjustable foot-board, and with bandages for securing the upper part of the patients body to the said staples, substantially as set forth.
Second, In combination with the staples, straps, shoe and bandages, making the mattress of a bed for the treatment of invalids in four parts, when the two central parts are secured to two slides, movable in lateral ways in the bed frame and over an evacuation aperture, substantially as and for the purpose set forth.

30,589.—H. H. Robertson and C. G. Carr, of Kingston, Missouri, for an Improvement in Cultivators:

We claim the arrangement for united operation, in a cultivator of two or more plows, G, or scrapers, N, a series of cross bars, L L', a series of adjustable buttons, J, perforated loops, E, and stop pins, I, substantially in the manner and for the purposes described.

30,590.—Joseph Rolls, of New York City, for an Improved Carpet Duster:

I claim the combination of the beaters, A A', brushes, C C', and take-up roller, F, substantially as described, so that, while the carpet is drawn through between the beaters and the brushes, both sides of the same are first exposed to the action of the beaters and afterwards to the action of the brushes, and a thorough dusting of the carpet is effected.

[The object of this invention is to effect the dusting of a carpet simultaneously on both sides by exposing it to the action of alternately acting rotary hinged beaters, and of alternately acting revolving brushes, in such a manner that both sides of the carpets are first well beaten and afterwards brushed off perfectly clean, each of the beaters and of the brushes acting as a point of resistance during the action of the other beaters or brushes.]

30,591.—J. G. Ross, of New York City, for an Improved Arrangement of Gates for Directing the Flow of Water Upon Tide Wheels:

I claim the arrangement of the gates, b d d', for directing the flow of water, in combination with the swinging gates, h h and i i, for regulating the filling or emptying of the pond, and with the gates, f f', to regulate the supply to the wheel, in the manner and for the purpose specified.

30,592.—C. A. Shaw, of Biddeford, Maine, for an Improved Pie Crimper:

I claim the knife and wheel, when combined to crimp and trim a pie at one operation, constructed substantially in the manner set forth and specified.

30,593.—Louis Simonet, of New York City, for an Improvement in Waterproof Fabrics:

I claim the varnished waterproof cloth, as described.

30,594.—Thomas Slaight, of Newark, N. J., for an Improvement in Door Latches:

I claim, first, The segment, F, attached to the end piece, d, of the case, A, and connected to the slide, B, essentially as and for the purpose set forth.
Second, Having the end, a, of the slide, B, fitted in the segment, F, so as to prevent any play of the latch consequent on a shrinking of the door or jamb, as described.

[The object of this invention is to facilitate the operation of the slide so that the same may, when its outer end comes in contact with the nosing in shutting the door, be readily forced back into its case; due provision being also made for the shrinking of the door and jamb, so that all play of the former will be avoided in consequence of any shrinkage of the parts aforesaid.]

30,595.—W. G. Smith, of Elizabethport, N. J., for an Improvement in the Cutting Apparatus of Harvesters:

I claim the slotted bar, B, and adjustable securing blocks, C, in combination with the securing wedge or key, D, and the removable sections, A, with the tell pieces, a, the whole constructed and operating substantially as described, for the purpose set forth.

30,596.—G. D. Trumpore, of Newark, N. J., for an Improved Clothes' Squeezer:

I claim the arrangement of the tub, B, platform, C, press tub, F, perforated in its circumference with holes, movable bar, D, screw, H, plunger, K, straps, F F, elbow rods, r r and n, and elbow screw, p, when used as and for the purposes specified.

30,597.—T. H. Willson and D. T. Willson, of Harrisburg, Pa., far an Improvement in Machines for Cutting Hay, &c.:

We claim, first, Casting a cutter head composed of two sets of radial arms united by a sleeve, all in one piece, and around a wrought iron axle, substantially as described, for the purpose set forth.
Second, The combination of the cutter head with adjustable knees when arranged on the face of both sets of arms, substantially as described, for the purpose set forth.
Third, Constructing the lower feed roller with transverse and longitudinal ribs upon its surface, for the purpose set forth.
Fourth, Attaching the stud carrying the intermediate pinion, K, to the side plate, G, substantially in the manner described, for the purpose set forth.
Fifth, Constructing the guides of the feed roller shaft with a curved slot, as described, in connection with the stud plate, arranged as described.
Sixth, Arranging the intermediate double pinion, q, on an adjustable stud, and supporting said stud by means of a radius bar, W, pivoted to the shaft of the feed roller, substantially as described, for the purpose set forth.
Seventh, The combination of the slotted stud plate with the double pinion, arranged as described, for the purpose set forth.

30,598.—J. S. Wheat, of Wheeling, Va., for an Improvement in Apparatus for Tanning:

I claim, first, The relative arrangement of the suction pipes, A A', force pumps, C, supply pipes, D D', communication pipes, D2 D3 D4 F F1 F2 F3, exit pipes, D5 D6 D7 D8 D9 D10, and emptying pipes, G G1 G2 G3 G4, in combination with reservoirs, E E1 E2 E3 E4 E5, vats, X1 X2 X3 X4, and weighted valve, T', for the double purpose of effecting a complete circulation of the tanning liquid and pressure upon the hides through all the vats, and allowing any of the vats to be shut off from the circulation going on through the other vats and to be emptied if desired, substantially as set forth.
Second, The frames H, in the vats, in combination with two eccentrics, I I, and connecting rods, L L1 L2 L3 L4 L5, so arranged that all of the frames may vibrate simultaneously, or any one of them remain at rest, if desired, while the others vibrate, substantially as set forth.

30,599.—D. C. Wilkinson, of Sidney, Ohio, for an Improved Flood Fence:

I claim the combination of the alternate zigzag panels, B C and B', gudgeons, E, oblong bearings, F, and cylindrical bearings, F', the said parts being so constructed and arranged as to operate in connection, substantially in the manner and for the purposes set forth.

30,600.—David Wadsword, Jr., of Nashua, N. H., for an Improved Gate Hinge:

I claim the described combination and arrangement of the fastening plates, A B, the cam, C, the stud, D, the rod, E, and the spring, G, the whole constituting an improved gate hinge, as explained.
I also claim the combination and arrangement of the groove, F, with the said fastening plates, the cam, stud, rod and spring applied and made to operate together, substantially as specified.

30,601.—L. B. Wright, of New York City, for an Improvement in Spinal Braces:

I claim, first, The combination of the spring clasps, A and B, with the head rest, composed of the parts, E F and O, when the same shall be combined and operated as sent forth, and for the purpose specified.
Second, In combination with the same, the plates, Q and R, arranged and operated as set forth and for the purpose described.

30,602.—John Adams, of Dalston, England, assignor to Thomas Poultney, of Baltimore, Md., for an Improvement in Revolver Fire-arms. Patented in England, Nov. 7, 1857:

I claim, first, The construction of the body of a revolver of two pieces of the form described, fitted and secured together substantially as specified.
Second The link, L, constructed and applied in combination with the trigger, and operating in combination with the notch, o, of the hammer, substantially as set forth.
Third, In combination with the link, L, applied as described, I claim the arrangement of the cocking dog and the sere, substantially as described.

[This invention consists in a certain improved construction of the body of the arm, whereby great strength is attained and facility is afforded for slotting and drilling out for the reception of the lock and rammer. It also consists in a certain improved construction of, and mode of applying and combining the several parts of the lock for the purpose of enabling the hammer to be raised and let fall by one pull of the trigger for rapidly repeated firing, or to be cocked by hand and only let off by the trigger, as in the older kinds of firearms for firing more deliberately and with more accurate aim, the object of the improvement being more especially to bring the parts of the lock into such relation as to enable them to be brought within a parallel slot cut in the body of the arm, and to be inserted and taken out without difficulty.]

30,603.—Benjamin Douglas (assignor to W. & B. Douglas), of Middletown, Conn., for an Improvement in Pumps:

I claim the use of tube, a a, for encasing the piston rod and preventing the escape of air through the stuffing box around the piston rod, when it also controls the upward movement of the check valve, substantially as set forth.

30,604.—Dyer Green (assignor to himself and J. H. W. Page), of Boston Mass., for an Improvement in Rice Hullers:

I claim my improved arrangement of the screw, C, the shaft, B, and the pivot and step, D, of the latter, with respect to the bottom, a, and the discharging valve or valves, F, of the mortar.

30,605.—Thomas King (assignor to I. A. Pulsipher), of Troy, N. Y., for an Improvement in Machines for Molding Candles:

I claim, first, The piston-like tip molds, D, made movable unequal distances on the sliding frame, F, and provided with the springs, v, or their equivalents, substantially as and for the purpose described.
Second, The clamp or clamps, G, or any equivalent therefor, applied to the projecting portion of the partly expelled candles, and elevated by means of a hoisting apparatus combined with the stand of molds, for the purpose of drawing the candles out of the molds, substantially as described.
Third, The combination and arrangement of the movable arms, M, on the tip mold frame, E, with the seats, k, and guides, l, on the stand of molds, and the seats, m, on the sliding frames, H H', as and for the purpose set forth.
Fourth, The wick holders, P, constructed and arranged upon the stand of molds, in the manner described.

30,606.—Lewis Layman (assignor to E. P. Whitney), of Westfield, N. Y., for an Improvement in Locks:

I claim the employment or use of a hub, E, provided with four arms, f, projecting in pairs from opposite sides of it, in connection with a reversible slide, C, having the prongs of its yoke or fork provided with heads or cross pieces, e e, the hub being applied to the yoke and all arranged essentially as and for the purpose set forth.

[This invention relates to an improvement in that class of locks and latches which are provided with reversible slides, for the purpose of adapting one and the same lock to either a right or left-hand door without inverting the former.]

30,607.—S. P. Patten, of New York City, assignor to himself and S. A. Nickerson, of Brooklyn, N. Y., for an Improvement in Capstan Windlasses:

I claim combining the capstan with the barrel of the windlass by means of a worm wheel, F, on the said barrel and an endless screw, L, on shaft, G, which which has the capstan barrel, J, and pawl rim, I, fitted to it substantially as described, the so-fitted pawl rim being furnished with one or more movable stops, K, to permit the operation in either of the modes specified.

RE-ISSUES.

Solomon E. Bolles, of Mattapoisett, Mass., for an Improved Machine for Raising and Transporting Stones. Patented April 10, 1855:

I claim my improved stone carriage or arrangement of derrick, C, open bed frame, A, and two separate or disconnected wheel axles or journals, substantially as specified.

I also claim the combination and arrangement of the auxiliary windlass, K, its line, l, pawl, h, and ratchet, i (or mechanical equivalent therefor), with the main windlass, I, the crank shaft, L, and their working gears, s t—the whole being to enable the machine to be operated substantially as specified.

EXTENSIONS.

Alfred Judson, of Rochester, N. Y., and T. D. Jackson, late of New York City, deceased (Elizabeth N. Jackson, administratrix), for a Bell Telegraph. Patent dated October 17, 1846. Re-issued December 26, 1848:

We claim, first, The combination of the bell, pulling wires, and machinery of the annunciator or telegraph as described, or equivalents thereto, with a face or register for indicating signals, whereby we are enabled to represent, when needed, a plurality of such signals at the same moment and have them all remain permanent and visible until the object for which they are made is answered.

Second, We claim the combination and arrangement of the drops with the tumblers, drop levers and slide, substantially in the manner and for the purpose set forth.

B. F. Palmer, of Philadelphia, Pa., for an Improvement in Artificial Legs. Patent dated November 4, 1846:

I claim the long tendon, E, the spring, k, and cord, l, respectively combining and acting upon the parts, a b c and d, substantially in the manner and for the purpose set forth.

I also claim the improved manner of forming the knee joint, uniting the parts, a and b to each other by means of the hemisphere at the lower end of a, the partial concave beveled to a thin edge on the front side of the upper end of b, and the pivot, g, combined and operating substantially in the manner set forth, for the purpose of obviating noise or friction in working.

I also claim the improved manner of forming the ankle joint, uniting the parts, b and c to each other, the rear side of the lower end of b being beveled to a thin edge passing over and inclosing the heel portion of that part of c in the rear of the front pivot, h, and the front upper part of c, at n, being brought to a thin edge and overlapping the lower end of the front side of b, substantially as set forth—thus forming a pliable joint that will work without noise and preserve its contour in all portions.

THE RISE AND PROGRESS OF INVENTIONS

During the period of Fourteen Years which has elapsed since the business of procuring patents for inventors was commenced by Munn & Co., in connection with the publication of this paper, the number of applications for patents in this country and abroad has yearly increased until the number of patents issued at the United States Patent Office last year (1859) amounted to 4,538; while the number granted in the year 1845—fourteen years ago—numbered 502—only about one-third as many as were granted to our own clients last year; there being patented, through the Scientific American Patent Agency, 1,440 during the year 1859. The increasing activity among inventors has largely augmented the number of agencies for transacting such business.

In this profession, the publishers of this paper have become identified with the universal brotherhood of Inventors and Patentees at home and abroad, at the North and the South; and with the increased activity of these men of genius we have kept apace up to this time, when we find ourselves transacting a larger business in this profession than any other firm in the world.

We may safely assert that no concern has the combined talent and facilities that we possess for preparing carefully and correctly applications for patents, and attending to all business pertaining thereto.

FREE EXAMINATION OF INVENTIONS.

Persons having conceived an idea which they think may be patentable are advised to make a sketch or model of their invention, and submit to us, with a full description, for advice. The points of novelty are carefully examined, and a reply written corresponding with the facts, free of charge. Address MUNN & CO., No. 37 Park-row, New York.

PRELIMINARY EXAMINATIONS AT THE PATENT OFFICE.

The advice we render gratuitously upon examining an invention does not extend to a search at the Patent Office, to see if a like invention has been presented there, but is an opinion based upon what knowledge we may acquire of a similar invention from our long experience, and the records in our Home Office. But for a fee of $5, accompanied with a model or drawing and description, we have a special search made at the United States Patent Office, and a report setting forth the prospects of obtaining a patent, &c., made up and mailed to the inventor, with a pamphlet, giving instructions for further proceedings. These preliminary examinations are made through our Branch Office, corner of F and Seventh streets, Washington, by experienced and competent persons. Over 1,500 of these examinations were made last year through this office, and as a measure of prudence and economy, we usually advise inventors to have a preliminary examination made. Address MUNN & CO., No. 37 Park-row, New York.

CAVEATS.

Persons desiring to file a caveat can have the papers prepared on reasonable terms, by sending a sketch and description of the invention. The government fee for a caveat is $30. A pamphlet of advice regarding applications for patents and caveats furnished gratis on application by mail. Address MUNN & CO., No. 37 Park-row, New York.

HOW TO MAKE AN APPLICATION FOR A PATENT.

Every applicant for a patent must furnish a model of his invention, if susceptible of one; or if the invention is a chemical production, he must furnish samples of the ingredients of which his composition is composed for the Patent Office. These should be securely packed, the inventor's name marked on them, and sent, with the government fee, by express. The express charges should be prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by draft on New York, payable to Munn & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents; but if not convenient to do so, there is but little risk in sending bank bills by mail, having the letter registered by the postmaster. Address MUNN & CO., No. 37 Park-row, New York.

REJECTED APPLICATIONS.

We are prepared to undertake the investigation and prosecution of rejected cases, on reasonable terms. The close proximity of our Washington Agency to the Patent Office affords us rare opportunities for the examination and comparison of references, models, drawings, documents, &c. Our success in the prosecution of rejected cases has been very great. The principal portion of our charge is generally left dependent upon the final result.

All persons having rejected cases which they desire to have prosecuted are invited to correspond with us on the subject, giving a brief history of their case, enclosing the official letters, &c.

FOREIGN PATENTS.

We are very extensively engaged in the preparation and securing of patents in the various European countries. For the transaction of this business we have offices at Nos. 66 Chancery Lane, London; 29 Boulevard St. Martin, Paris; and 26 Rue des Eperonniers, Brussels. We think we can safely say that three-fourths of all the European patents secured to American citizens are procured through our Agency.

Inventors will do well to bear in mind that the English law does not limit the issue of patents to inventors. Any one can take out a patent there.

Circulars of information concerning the proper course to be pursued in obtaining patents in foreign countries through our Agency the requirements of the different Patent Offices, &c., may be had gratis upon application at our principal office, No. 37 Park-row, New York, or either of our branch offices.

TESTIMONIALS.

The annexed letters, from the last three Commissioners of Patents, we commend to the perusal of all persons interested in obtaining Patents:—

Messrs. Munn & Co.:—I take pleasure in stating that while I held the office of Commissioner of Patents, MORE THAN ONE-FOURTH OF ALL THE BUSINESS OF THE OFFICE CAME THROUGH YOUR HANDS. I have no doubt that the public confidence thus indicated has been fully deserved as I have always observed, in all your intercourse with the Office, a marked degree of promptness, skill and fidelity to the interests of your employers. Yours, very truly,

CHAS. MASON.

Immediately after the appointment of Mr. Holt to the office of Postmaster-General of the United States, he addressed to us the subjoined very gratifying testimonial:—

Messrs. Munn & Co.:—It affords me much pleasure to bear testimony to the able and efficient manner in which you have discharged your duties of Solicitors of Patents while I had the honor of holding the office of Commissioner. Your business was very large, and you sustained (and, I doubt not, justly deserved) the reputation of energy, marked ability and uncompromising fidelity in performing your professional engagements. Very respectfully,

Your obedient servant, J. HOLT.

Messrs. Munn & Co.:—Gentlemen: It gives me much pleasure to say that, during the time of my holding the office of Commissioner of Patents, a very large proportion of the business of inventors before the Patent Office was transacted through your agency, and that I have ever found you faithful and devoted to the interests of your clients, as well as eminently qualified to perform the duties of Patent Attorneys with skill and accuracy. Very respectfully,

Your obedient servant, WM. D. BISHOP.

Notes and Queries

J. A. C., of C. W.—Electricity from a galvanic battery can be accumulated by means of a Leyden jar if the battery is one of high intensity, that is, consisting of a considerable number of plates. Connect one pole with the inside of the jar and the other with the outside.

S. F., of Pa.—The reporter, doubtless, meant to say that, by raising the temperature of iron from 1,000° to 1,500°, the light emitted from it is increased forty fold.

R. S., of Mass.—You can reduce quartz to a liquid by grinding it to powder, then boiling it in a close vessel with a strong caustic alkali.

L. A. L., of N. Y.—A small portion of calcined alum in powder added to black lead, and mixed with some beer and a little asphalt varnish (made with turpentine and asphalt) should make a good stove polish to prevent the metal rusting in your laboratory.

M. S., Jr., of La.—The walls of the basements of houses in this city situated near the rivers, and exposed to tidal overflows, are usually laid in hot asphalt. The arches of cellars laid under the sidewalks in our streets are also usually covered with hot asphalt; no other cement seems to be as good for keeping out water from the surface. Cisterns made in the "bottoms of the Mississippi," subject to overflows, if coated inside with good hydraulic cement and outside with hot asphalt, should be perfectly tight. The hydraulic cement which you have used seems to have been of an inferior quality.

R. R. T., of N. Y.—The bill to amend the Canadian Patent Law did not pass at the last session of Parliament. American inventors are excluded from taking patents in Canada at present. It is a shame and disgrace.

W. H. H., of Tenn.—A large building in Paris which had one of its stone walls bulging outward was straightened by running an iron rod through the walls, on the outer end of which was a broad plate of metal placed inside of a nut working on the screw of the rod. By heating the rod inside of the building, the metal expanded; then the nut, with its broad plate, was screwed up close to the face of the wall against the bulged part. When the rod cooled, the force of contraction in the metal was so great that it straightened the wall in a very satisfactory manner. This plan you could employ for your brick house; but it may be too troublesome and expensive. We do not remember any other method that we could recommend. Probably your house may be able to stand for quite a number of years, with its uneven walls.

F. D., of N. Y.—Mildew may be removed from white linen and cotton clothes by washing and bleaching, and especially by using a little chlorine water for the bleaching action. By placing a little salt on the mildew stains, then squeezing some lemon juice and hot water upon them, they will also be removed. Good brushing and a little alcohol rubbed on with a sponge afterward is the only treatment we recommend for mildew on woolen goods.

W. M. McA., of Pa.—You will find most of the facts known in regard to aluminum in back numbers of the Scientific American. It is a bluish-white metal, very light, its specific gravity being 2.56. It is easily worked, and can be hammered, rolled or cast: its melting point being about the same as that of silver, which is 1,873° Fah. It is nearly as strong and stiff as iron, and forms alloys with gold and other metals.

E. M. C., of R. I.—There are many plants which contain india-rubber in small quantities. The common milkweed is a specimen.

K. S. W., of Ga.—The stains made on fine linen with the oil from sewing machines are very difficult to remove; but this can be done with a little oxalic acid in solution after the oil is washed out. The color is due to the oxyd of iron in the oil, which cannot well be removed from light colored woolen without injury to the texture of the fabric.

S. D. T., of N. Y.—You may preserve your cider good and perfectly sweet for a long time by keeping it in close casks and placing a very small quantity of the bisulphide of lime in each.

D. C., of Va.—We are glad to know that you are doing well with your invention. We cannot advise you, however, to apply for a patent on the washing machine. A roller swinging over a corrugated concave bottom is an old device. We hope you will succeed in procuring us a good club of subscribers to our paper for the new volume, which will commence on the first of January.

M. P. F., of N. Y.—The mauve dye is made of aniline and the bichromate of potash. The description for making the purple dye from coal tar you will find on page 68, Vol. II., of the Scientific American.

J. S., of N. Y.—Amber varnish for violins is thinned with refined turpentine to reduce it to a proper condition for application. In varnishing a violin, all the old varnish should be carefully scraped off before the new is applied, unless a very thin coat is required.

J. Y. H., of Pa.—We do not think your plan of a long canvas screw for a flying machine as good as a short spiral. There will be no difficulty, however, in arranging the apparatus, if an engine is produced of sufficient power in proportion to its weight to raise itself by turning fans.

C. L. P., of N. Y.—We hope you may be successful with your lath machine. It is a good plan to try experiments as you are doing, and thus settle the practical value of your invention at the outset.

C. C. P., of Texas.—You are evidently possessed of much inventive talent, and it only needs to be directed toward practical results to be crowned with success. It is not a part of our business to negotiate the sale of inventions, but we advise you to find a capitalist at home to aid you in developing your improvements. Do not get too many irons in the fire.

MONEY RECEIVED

At the Scientific American Office on account of Patent Office business, for the week ending Saturday, Nov. 10, 1860:—

B. T. B., of N. Y., $30; T. N. R., of N. Y., $110; G. A. D., of Cal., $12; M. A. W., of Cal., $50; G. S. K., of Wis., $20; E. W. K., of Ill., $30; S. A. Co., of N. Y., $525; P. L., of N. Y., $25; C. & E., of Ohio, $10; J. G., of Ohio, $25; J. G. W., of N. Y., $300; E. G. D. of N. Y., $30; A. L. B., of Mass., $30; D. H. F., Jr., of Mo., $30; H. & M., of Ohio, $30; E. C. T., of N. Y., $30; H. N., of N. Y., $25; W. C., of N. Y., $25; T. N. H., of Mo., $35; J. C. T., of Ill., $30; J. R. I., of N. Y., $250; H. M. B., of Ohio, $25; S. K. W., of Pa. $20; E. D., of N. Y., $25; S. N. C., of Md., $250; S. W., of Ga., $30; J. K., of N. Y., $38; J. E. G., of Ill., $250; H. & W., of Mass., $58; G. P. R., of Mass., $30; G. & S., of Mich., $15; E. S., of N. Y., $30; B. M., of N. Y., $30; E. H. B., of N. Y., $25; A. L. F., of Pa., $55; P. H., of Mass., $30; A. L. S., of S. C., $30; T. K., of N. Y., $30; N. J., of N. Y., $25; J. S., of N. J., $25; L. A. G., of N. Y. $25; P. S., of N. Y., $30; W. H. R., of N. Y., $250; J. H. R., of Tenn., $25; H. & S., of Pa., $30; C. B. T., of Cal., $20; D. M., of Ohio, $30; B. D. T., of N. Y., $25; J. B. of Germany, $25; J. L., of N. Y., $25; O. R. B., of N. Y., $12; S. & S., of Pa., $30; R. C. M., of S. C., $25; H. F., of La., $30; W. S., of Pa., $25; J. S. R., of Iowa, $10.

Specifications, drawings and models belonging to parties with the following initials have been forwarded to the Patent Office during the week ending Saturday, Nov. 10, 1860:—

T. N. R., of N. Y. (2 cases); P. C., of N. Y.; F. W. R., of Ind.; H. C. A., of Ill.; G. W. C., of Texas; J. L., of N. Y.; M. & S., of Ky.; B. D. T., of N. Y.; A. L. F., of Pa.; E. P., of Mass.; J. G., of Ga.; R. C. B., of N. C.; C. W., F. of Ill.; P. M., of Mich.; T. E. B., of Fla.; O. R. B., of N. Y.; H. N., of N. Y.; R. C., of Texas (2 cases); E. H. B., of N. Y.; J. R. J., of Ky.; C. & S., of Pa.; W. C., of N. Y.; J. T. P., of Conn.

USEFUL HINTS TO OUR READERS.

BACK NUMBERS AND VOLUMES OF THE SCIENTIFIC AMERICAN.—New subscribers to the SCIENTIFIC AMERICAN can be furnished with the back numbers of this volume by signifying their wish to receive them, otherwise their paper will be sent from the date of receiving the subscription. Vols. I. and II. (bound or unbound) may be had at this office and from all periodical dealers. Price, bound, $1 50 per volume; by mail, $2, which includes postage. Price in sheets, $1. Every mechanic, inventor, or artisan in the United States should have a complete set of this publication for reference. Subscribers should not fail to preserve their numbers for binding.

SUBSCRIBERS TO THE SCIENTIFIC AMERICAN who fail to get their papers regularly will oblige the publishers by stating their complaints in writing. Those who may have missed certain numbers can have them supplied by addressing a note to the office of publication.

GIVE INTELLIGIBLE DIRECTIONS.—We often receive letters with money inclosed, requesting the paper sent for the amount of the enclosure, but no name of State given, and often with the name of the Post-office also omitted. Persons should be careful to write their names plainly when they address publishers, and to name the Post-office at which they wish to receive their paper, and the State in which the Post-office is located.

INVARIABLE RULE.—It is an established rule of this office to stop sending the paper when the time for which it was prepaid has expired; and the publishers will not deviate from that standing rule in any instance.

RATES OF ADVERTISING

THIRTY CENTS per line for each and every insertion, payable in advance. To enable all to understand how to calculate the amount they must send when they wish advertisements published, we will explain that ten words average one line. Engravings will not be admitted into our advertising columns; and, as heretofore, the publishers reserve to themselves the right to reject any advertisement sent for publication.

AMERICAN RAILROADS AND AMERICANISMS IN LONDON.

It is well known that our countryman, Mr. G. F. Train, has introduced street railroads into Liverpool and Birkenhead, England, and he is now in London endeavoring to introduce the system into the British metropolis. At a dinner given to him by some of the public men of London, he made a characteristic speech, and remarked that "as a nation," the English language was more accurately and purely spoken in the United States than in Great Britain. The remarks created loud laughter, whereupon the speaker exclaimed:

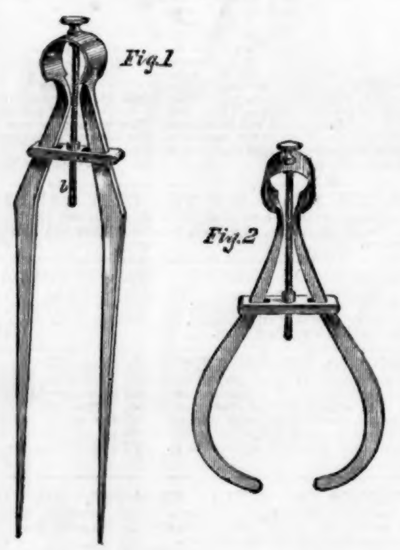
"I will prove it. Order your dinner in every village from Maine to California, and they will understand you for 16,000 miles! but go 500 miles, from Aberdeen to Dover, and you can loose yourself in a Babel of tongues. Remember, gentlemen, the Americans don't speak Gaelic, or Manx, or Celtic, or Welsh—(laughter)—and, I assure you, upon my honor, Yorkshire and Lancashire are not taught in our common-schools (laughter); and I am informed, on good authority, that there are no professors of Irish or Scotch in our academies. (Applause.) Lindley Murray, Lord Lyndhurst, and Noah Webster, were all Americans! Our written language will always be English—our spoken language is American. The time has arrived to state that Sam Slick is not an American institution! that American securities are safer, and pay better, than those of any other nation—(Oh!)—that the almighty dollar is not so much respected in the social world by the Americans, as the almighty shilling by the English—(Oh! and laughter)—that Americans never filibuster, while England never did anything else—(Hear, hear, and applause)—that our people, as a people, are more temperate, more moral, better educated, and better dressed, than their illustrious predecessors—(Hear, and roars of laughter)—and that the tooth-brush story, like Arrowsmith's railways and revolvers in Georgia, has turned out to be a hoax. (Laughter and applause.) England views mankind from a first-class carriage—hence, when a few thousand West-Enders go to the sea-side, they say everybody is out of town! What egotism! All the misconception has arisen by comparing the English dress circle, with the American pit—or Oxford and Cambridge against all America! Compare dress-circle with dress-circle, gallery with gallery, pit with pit, and then America will receive justice in Europe. (Applause.) * * * * England has always been looking out of the cabin at America in the forecastle—England has been the pulpit, America the audience—England the schoolmaster, Americans the scholars. That day has passed away. A published idea is an expired patent."

The London *Star* of t e 12th ult., says "the Metropolitan Street Railroad question was again brought before the Marylebone Representative Council yesterday. The enterprising Mr. Train attended in support of his plan, and Mr. Wilkinson, on behalf of the London General Omnibus Company, and a gentleman named Curtis appeared for the purpose of urging delay—both of these parties having schemes of their own to promote. The vestry, however, resolved, by a very decided majority, to accede to Mr. Train's application. We may soon expect to see these street railroads as common in England as they are in the great cities of America."

THE ELECTRICITY OF THE TORPEDO.

The results of some curious experiments on the electricity of the torpedo have been recently published by the distinguished Italian naturalist, M. Matteucci. We learn that the electro-motive power of the organ of the torpedo exists independently of the immediate action of the nervous system. If a section of the electric organ of the torpedo which has been dead 48 hours, or if the torpedo be exposed for the same number of hours to the action of the open air, or left for 24 hours in a frigorific mixture where it may have hardened or become frozen, or if kept during the latter period in water at a temperature from 104° to 122°, be made to communicate with a galvanometer, a great deviation will be produced. If the torpedo be killed with the poison curare or woorali, it will present the same electro-motive power as if it had died naturally. In its operations as a nerve discharging battery, its electro-motive power is considerably increased under stimulated action. When the nerves of the organs have been several times excited in succession, that power for which the torpedo is so remarkable is greatly increased, and will produce a greater number of discharges than it would in its normal condition. For instance:—Let two pieces of equal dimensions, each containing a strong nervous filament, be prepared on one of the organs of a torpedo; let them be placed on a piece of gutta-percha with the two nerves opposite to each other, and situated perpendicularly to the prisms of a thermo-electric apparatus; on closing the circuit of the galvanometer, a small differential current becomes apparent, but soon disappears. Then if the nerve of a galvanoscopic frog be placed upon each organ, and the circuit be broken under a mercury bath while the nerve of one of the pieces is being irritated with the points of a fine pair of scissors, the frog then in contact with that piece will exhibit violent convulsions. When after this the nerve is left at rest, and the circuit of the galvanometer again closed, a strong deviation, which lasts a long time, is perceived in the direction of the excited organ. The electro-motive power of the organ of a torpedo is not influenced by the nature of any gaseous medium in which it may be left for twenty-four hours. This is proved by comparing, in opposition to each other, two pieces preserved in different gases such as hydrogen, oxygen, carbonic acid, and atmospheric air more or less rarified; when it will appear that there is no constant difference between the electro-motive powers of the two pieces.

STRANGE'S IMPROVEMENT IN SPRING DIVIDERS.



The neat and compact dividers and calipers represented in the annexed cuts were invented by Joseph W. Strange, of Bangor, Maine, and the invention was secured by Letters Patent, dated Sept. 11, 1860. The improvement is so clearly displayed by the engravings, as to hardly require a description. Instead of the ordinary screw through the two legs of the instrument, the legs are passed through a sliding yoke, *a*, and their divergence is varied as desired, by turning the screw, *b*, which works through the yoke and through the middle of the bow.

By this means, a neat and symmetrical instrument is produced, which is perfectly balanced and has no long screws or thumb pieces projecting from its sides.

Further information in relation to this invention may be obtained by addressing John S. Jenness, the assignee of the patent, at Bangor, Maine.

The remarkable number of suicides that have taken place lately has greatly occupied the attention of psychologists and physiologists. M. Bierre de Boismont has lately read an essay upon general paralysis and its premonitory symptoms. The symptom to which he attaches most importance is a complete change in the habits and character of the person attacked. When an individual who, naturally gentle and patient, becomes subject to fits of violent anger, or a person sincerely Christian and of pure morals, assumes a strange liberty of thought and manners, we shall not once in a hundred times deceive ourselves if we take these symptoms as prognostics of a disorder of the brain, which will soon degenerate into general paralysis.

IMPORTANT TO INVENTORS.

The United States Patent Office at Washington contains nearly 30,000 models pertaining to patented inventions, all of which are open to public inspection and examination, together with the drawings and specifications relating thereto. But the distance of the capital, and the time and expense involved in a journey thither, deters, in effect, the majority of inventors from reaping the advantages which a personal examination of previously patented inventions might oftentimes give them. To obviate this difficulty we are in the habit of making these examinations at the Patent Office for inventors. When it is desired to ascertain definitely whether an invention, believed to be new, has been previously made, or to what extent, if any, it has been anticipated, the applicant sends to us a rough sketch and description of the device. We then make a thorough examination in the Patent Office at Washington, and report the result to the applicant. The charge for this service is only $5; and it is frequently the means of saving the applicant the entire expense of preparing a model, paying government fees, &c., by revealing the fact that the whole or a material portion of his improvement was previously known. This preliminary examination is sometimes also of importance in assisting to properly prepare the papers, so as to avoid conflicting with other inventions in the same class. The reader should carefully note the distinction made between this preliminary examination at the Patent Office and the examination and opinion given at our own office, either orally or by letter, for which no fee is expected. It is only when a special search is made at the Patent Office that the fee of $5 is required. We are able, in a vast number of cases submitted to us, to decide the question of patentability without this special search.

The Big Ship.—The latest accounts which we have of the *Great Eastern* is that she is sitting fast on her gridiron at Milford Haven, and that the captain and all hands are paid off. It is reported that she will nestle in this manner all winter. It is also stated that it has been impossible to get at some parts of her bottom, to coat it with paint, so that she will be in great danger of being injured by rust.